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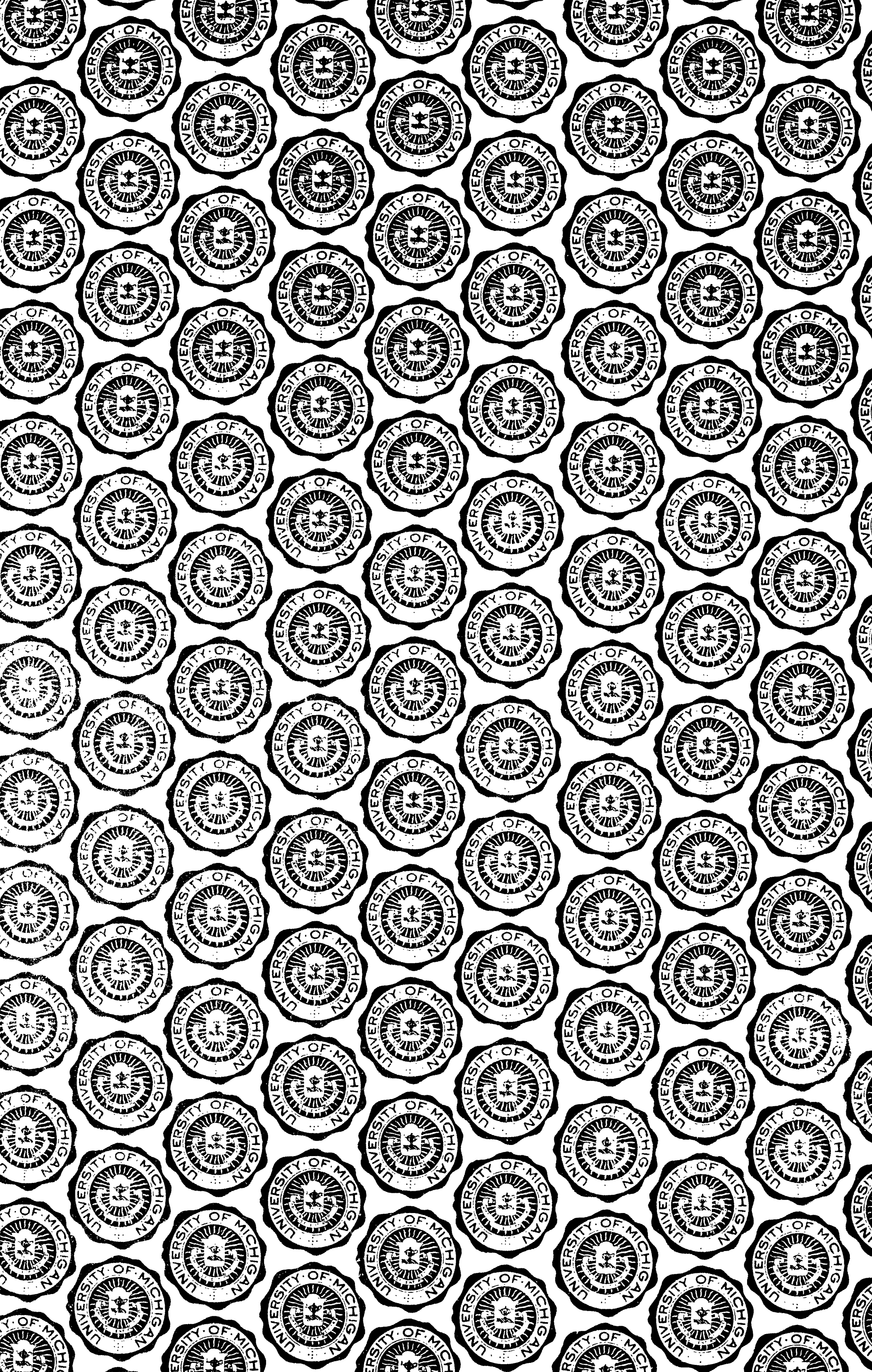
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WITH 32 PLATES AND 18 TEXT FIGURES

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THE PHILIPPINE
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EXPERIMENTAL PNEUMONIA IN MONKEYS [1]

By OTTO SCHÖBL

Of the Division of Biology and Serum Laboratory, Bureau of Science, Manila

and

ANDREW WATSON SELLARDS

Of the Harvard Medical School, Department of Tropical Medicine, Boston, and the Bureau of Science, Manila

FIVE PLATES AND TWO TEXT FIGURES

INTRODUCTION

The facility with which the pneumococcus produces either a lobar or a lobular disease of the lungs gives this microörganism a position almost unique among the bacteria causing pneumonia. No precise understanding exists concerning the essential factors which determine the type of lesion that will ensue from a pneumococcus infection. In the experimental work on animals the outstanding feature is the great difficulty of simulating accurately the development of lobar pneumonia as seen in man. Wadsworth(16) in 1904 emphasized the importance of an accurate and, presumably, very delicate balance between the virulence of the pneumococcus and the degree of resistance of the host for the production of lobar lesions. Since that time little progress was made in the experimental production of pneumonia until 1920, when the important work of Blake and Cecil(2) stimulated interest anew in this field. These investigators produced pneumonia readily by observing three simple conditions; namely, the inoculation of monkeys with pneumococci by intratracheal injection of a strain which was highly virulent for mice. The resulting pneumonia was interpreted by Blake and Cecil as identical in all of its aspects with human lobar pneumonia. Not only did this work furnish a new impetus for the study of pneumonia, but it also revived interest in the procedure of intratracheal injection for the study of respiratory diseases.

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[1] From the Division of Biology and Serum Laboratory, Bureau of Science, Manila.

TECHNIC

In the following work it has seemed to us clearly desirable to follow closely the technic of Blake and Cecil in order to secure successful results. The species of monkey used appears to be of considerable importance. The degree of virulence of the pneumococcus is, of course, a vital factor, and perhaps even the type is an important consideration.

In their first experiments Blake and Cecil obtained equally good results with monkeys of two genera; namely, the Philippine *Pithecus philippinensis* Geoffroy (synonyms, *Macacus philippinensis* and *M. syrichtus*) and the South American *Cebus capucinus.* In some later work, Cecil and Steffen(6) reported only partially satisfactory results with the capuchin monkeys and virtual failure in the case of the Indian monkey *M. rhesus.*

As regards the pneumococcus, Blake and Cecil employed cultures of such virulence that 0.000,000,1 cubic centimeter of a broth culture would kill a mouse within forty-eight hours after intraperitoneal inoculation. No precise information is given concerning the measures employed to maintain the virulence of the cultures during the period of experimentation. It seems clear, however, that cultures recovered from monkeys were not employed for subsequent inoculation of other monkeys, since no mention is made of the introduction of any such factor into the experiments. Cultures of each of the four types of pneumococcus which were of equal virulence for mice behaved very differently upon intratracheal inoculation into monkeys. Type I produced a fatal pneumonia regularly, even in small dosage (0.001 cubic centimeter of a broth culture) and frequently in minute quantities (0.000,001 cubic centimeter). Types II, III, and IV, even in rather large amounts (0.1 to 1 cubic centimeter), did not cause fatal infection. Of course, it does not follow that this difference between type I and the remaining types would necessarily be constant.

For the work reported here, we used the Philippine monkey, *Pithecus philippinensis* Geoffroy,(8) and a type I pneumococcus—a subplant from the original type I strain of Neufeld. The stock culture was grown on the semisolid serum agar medium of Wadsworth(17) (one part of beef infusion agar 3 per cent p_H 7.4–8 is melted and cooled to 50° C. and then mixed with five parts of normal horse serum warmed to 50° C.). Broth cultures, after eighteen to twenty hours incubation, were used for the inoculation of the mice and the monkeys; that is, a standard veal infusion without the addition of sugar and having a reaction of p_H 7.6.

For the intratracheal inoculations the position of the animal is important, as regards both the ease of injection and the subsequent location of the lesions in the lungs. We placed the monkey on its back, with a pad under the chest, the head being extended as in the position for tracheotomy in man. The culture was drawn up into the syringe and then the contaminated needle was replaced by a fine sterile one (0.5 millimeter diameter). We uniformly used a volume of 1 cubic centimeter of fluid. The inoculation was made in the usual way by direct puncture through the skin into the lumen of the trachea below the larynx.

The operator can very conveniently recognize the moment that the needle has entered the lumen. On drawing up the culture into a Luer syringe, a small air bubble can readily be trapped in the nozzle. When the needle is free in the trachea, this air bubble passes downward and the column of fluid in the syringe sinks into the nozzle.

EXAMINATION OF NORMAL MONKEYS FOR PNEUMOCOCCI

As a preliminary step thirteen of the stock monkeys were examined for pneumococci. These animals were originally caught in the Philippine forests and had been kept in the animal house of the Bureau of Science for periods varying from a few weeks to approximately one year. A small amount of saliva (0.5 to 0.25 cubic centimeter) from each monkey was injected intraperitoneally into each of several white mice. Some of the mice were found dead on the morning after injection, and of the remainder all but one or two were critically ill. Cultures were made from the heart blood on "chocolate" agar. From eleven of the thirteen specimens an abundant growth was obtained, frequently in pure culture, of a Gram-positive micrococcus producing green pigment.

Eight of these eleven cultures did not resemble the typical pneumococcus in their morphology; they were not soluble even in whole bile (beef and rabbit) and did not ferment inulin. On testing with specific agglutinating sera, one of these strains agglutinated readily in the control preparation in physiological salt solution and four agglutinated readily in type I serum but not in the serum of type II or III, nor in salt solution. This test was repeated five times, and agglutination with the four strains occurred frequently in type I serum, though not invariably. Furthermore, agglutination occurred only when whole serum was used, but not in any of the dilutions, whereas a stock strain of type I pneumococcus agglutinated readily in a final serum dilution of 1 : 20. We do not wish to be understood as suggesting that such inconstant agglutination implies any relationship of this organism to the pneumococcus.

The three remaining strains that produced green pigment proved to be typical pneumococci, as shown by their morphology, capsule formation and staining reaction, prompt solubility in bile, and fermentation of inulin. The solubility in bile was tested by mixing equal parts of a young broth culture with a 20 per cent dilution of beef bile in physiological salt solution. Complete clearing took place within five to fifteen minutes at room temperature. The fermentation of inulin was tested in Hiss serum water medium(10) using one part of beef serum and three parts of water with 1 per cent of inulin and bromcresol purple as indicator (10 cubic centimeters of the usual 0.04 per cent solution to 90 cubic centimeters of serum water). A definitely acid reaction developed within twenty-four hours, and coagulation took place with two of these strains within three days. No hæmolysis occurred on blood agar plates.

The types were determined by macroscopic agglutination tests, using a broth culture of the organism and specific sera shown to be effective for known strains of types I, II, and III. Two of the strains were found to belong to type IV and one to type III.

The three strains of pneumococci obtained from the stock monkeys were tested for virulence on three mice and on three normal monkeys from which no pneumococci were obtained. The mice were injected intraperitoneally with 0.1 cubic centimeter and the monkeys intratracheally with 1 cubic centimeter of an eighteen-hour culture. All of the animals remained well.

The occurrence of the pneumococcus in the mouths of healthy monkeys has a direct bearing upon one of the unexpected results obtained by Blake and Cecil.(2) In experiments on infection by contact, these investigators placed some healthy monkeys in a cage with two monkeys in the active stage of a type I pneumonia. Six days later, one of the healthy monkeys developed pneumonia caused by a type IV organism, as shown by blood culture. The suggestion has been offered by King(12) that this experiment may indicate either a mutation of type in the pneumococcus or "type multiplicity of infection." Even though the pneumococci we found in stock monkeys were avirulent for healthy animals, it seems unnecessary to accept the view of mutation of type in this experiment on contact infection.

We have no means of knowing whether the monkeys that carried pneumococci acquired their infection in nature or in captivity. At the Bureau of Science laboratory, only one laborer is assigned to the care of the stock monkeys and, on examination at this time, he was not found to be a carrier of pneumococci. Cecil and Blake(5) definitely take the view that monkeys in their natural environment rarely encounter the pneumococcus. However, there is considerable evidence indicating that the pneumococcus can propagate itself in lower animals independently of human infections. Smith(15) has emphasized the wide dissemination of pathogenic pneumococci among guinea pigs. Christiansen(7) described the simultaneous occurrence of a pneumococcus infection in calves and in guinea pigs in the serum laboratory at Copenhagen.

INOCULATION OF MONKEYS WITH THE PNEUMOCOCCUS

At the commencement of these experiments, the stock culture of pneumococcus possessed only a moderate degree of virulence for white mice, 0.000,01 cubic centimeter of a broth culture eighteen to twenty-four hours old having been found to be fatal within forty-eight hours after intraperitoneal inoculation. Four monkeys inoculated intratracheally with 1-cubic centimeter amounts of the culture at this time remained well. By rapid passage through a series of eighteen white mice the culture increased gradually in virulence until 0.000,000,1 cubic centimeter killed mice regularly within thirty-six to forty-eight hours, and 0.000,000,01 cubic centimeter was fatal occasionally but not regularly. This degree of virulence was maintained without difficulty by the passage of the stock strain through mice twice each week during the course of these investigations. The cultures recovered from infected monkeys were not used for the inoculation of other monkeys; it was desired to keep the conditions of the experiment as nearly constant as was feasible, with the object of developing a method that would give reasonably uniform results.

The virulence of this strain for monkeys was then tested by intratracheal, intravenous, and subcutaneous inoculation. Intratracheally, 1 cubic centimeter of the undiluted broth culture was frequently but not constantly fatal. Twelve of nineteen monkeys died or were sacrificed within seventy-seven hours after injection; of the seven remaining animals, the majority were sacrificed after one to two weeks. Some showed pulmonary lesions, and others were free from pneumonia.

Five monkeys were injected intravenously with 1 cubic centimeter and one with 0.5 cubic centimeter of undiluted culture. Three of these six animals also received other minor forms of treatment. All died in less than three days. Six monkeys were inoculated subcutaneously. Two received 0.01 cubic centimeter, one was given 0.1, and another 0.5; two received 1 cubic centimeter each of broth culture. Five of these animals remained free from any local or general symptoms; one of the two injected with 1 cubic centimeter died within twenty-four hours, but without any pulmonary lesions. In Table 1 we have recorded the results of the intratracheal inoculation of monkeys with a type I culture of pneumococcus virulent for mice.

The temperature of some of the first animals in the series was taken twice daily, but no reactions occurred that were definitely above normal. One animal that remained apparently well showed on one afternoon a temperature of 103° F.; in another, which died, the maximum temperature after injection was 102.5° F.

No cultures were made except at autopsy. The recovery of the pneumococcus was verified by inulin fermentation and bile solubility tests, and by agglutination of the culture with specific sera.

One of the significant features is the individual variation in the behavior of a group of monkeys inoculated intratracheally on the same day with the same amount of a given culture of pneumococcus. This variation was not traceable directly to the difference in weight nor to the apparent condition of the animals.

Inoculation of highly diluted cultures was not tested, in view of the frequent failure to produce pneumonia with the rather massive injection of 1 cubic centimeter of undiluted culture. However, the use of this amount of material is not particularly

TABLE 1.—*Intratracheal inoculation of Pithecus philippinensis Geoffroy with 1 cubic centimeter of broth culture of type I pneumococcus.*

	Serial No.	Weight.	Result.	Culture for type I pneumococcus.[a]	Remarks.
		g.			
	18	1,500	Sacrificed, forty-eight hours	+	Extensive pneumonia.
Simultaneous inoculations	8	2,850	Sacrificed, nine days	0	Maximum temperature 101^{6}. Two small areas of healing pneumonia.
	9	2,640	Died during first day	+	No pneumonia.
	10	1,800	Died during second day	+	Extensive pneumonia.
	11	1,600	Sacrificed, nine days	0	Maximum temperature 102^{4}. No pneumonia.
	12	1,850	Sacrificed, end of second day	+	No pneumonia. One colony from 1 cubic centimeter blood.
	13	1,320	Sacrificed, end of third day	+	One small focus of pneumonia.
Simultaneous inoculations	19	2,000	Died in twenty-six hours	+	Extensive pneumonia.
	20	1,400	Sacrificed, fourteen days	0	No pneumonia.
	21	1,650	do	0	Do.
	22	1,320	Sacrificed, twenty-six hours	+	Three small foci of pneumonia.
	23	1,750	Sacrificed, seven days	+	Pneumonia; growth of pneumococcus from lungs only.
	24	2,150	do	+	Pneumonia.
Simultaneous inoculations	35	2,250	Sacrificed in ten hours	+	Early hæmorrhagic lesions.
	36	2,050	Sacrificed in twenty-three hours	+	No pneumonia.
	37	4,900	Died during second day	+	Do.
	38	2,350	Died in fifty hours	+	Pneumonia.
	6	1,500	Remained well	—	
	7	3,700	Died in seventy-seven hours	+	Extensive pneumonia.

[a] +, type I pneumococcus; 0, growth; —, culture omitted.

objectionable. Permar(14) has emphasized the point that the size of the dose and the quantity of fluid are less important than is the virulence of the organism used for inoculation.

INTRAVENOUS INOCULATION OF PNEUMOCOCCI WITH INTRATRACHEAL INOCULATION OF STERILE MATERIAL

From the histological picture Blake and Cecil(3) concluded that the pulmonary lesions following the intratracheal injection of pneumococcus are of bronchogenic and not of hæmatogenic origin. Furthermore, these investigators inoculated two monkeys intravenously with a broth culture of the pneumococcus. Death occurred without the development of pneumonia. Our work has given similar results. The intravenous injection of pneumococci affords an experimental control for the evidence obtained from histological studies. In order to enhance the value of the control work it is obviously of interest to combine with the intravenous injection of virulent pneumococci, the intratracheal injection of sterile broth or killed broth cultures of pneumococci. Such material, being more or less irritating to the alveoli, might conceivably influence the localization of pneumococci during the course of a septicæmia. In our experiments such injections were without any significant effect. Eight monkeys were injected intravenously with a type I pneumococcus and five of them were given an intratracheal injection of 1 cubic centimeter of either sterile broth or a broth culture of pneumococcus killed by heat, using an eighteen-hour culture of virulent type I which had been heated for fifteen minutes at 55° C. One of the monkeys survived; the remaining seven died within three days with the usual signs of septicæmia and with hæmorrhages in the pericardium, but without pneumonia.

The results of the intravenous and subcutaneous injections are summarized in Tables 2 and 3.

From the data recorded in Table 2 it is seen that the intravenous inoculations killed the animals more promptly and more regularly than did the corresponding intratracheal inoculations. These results are distinctly different from those recorded by Blake and Cecil,(2) which indicate that fatal infections in monkeys are much commoner after intratracheal inoculation than after intravenous or subcutaneous injection. Thus, they found that of three normal Philippine monkeys inoculated subcutaneously with 0.001 cubic centimeter of a pneumococcus culture, one died; one of two normal Philippine monkeys died after inoculation intravenously with 0.001 cubic centimeter of culture. In contrast to these, they inoculated five Philippine monkeys intratracheally with 0.001 cubic centimeter of pneumococcus culture and all of these animals died; with only 0.000,001 cubic centimeter of culture, four of nine monkeys died after intratracheal inoculation.

Our own results do not indicate any extreme susceptibility of the Philippine monkey to the pneumococcus when tested in the Tropics under conditions approximating the animal's natural environment. Using the same type of pneumococcus of the same degree of virulence for mice as employed by Blake and Cecil, we found that relatively large dosages were required to produce a fatal infection of the monkeys, regardless of whether the inoculation was made by the intratracheal, the intravenous, or the subcutaneous route.

In the thirteen years' experience of one of us in the Bureau of Science laboratory, all monkeys that died from any cause whatever were autopsied and in no case was a pneumococcus pneumonia found, although, as we have shown, the monkeys may occasionally be carriers of the pneumococcus. Blake and Cecil(2) rightly emphasize the desirability of producing pneumonia experimentally by methods which do not involve preliminary injury of the lung or the use of measures that lower the general resistance of the animal. However, these authors(4) describe carefully an extensive outbreak of spontaneous pneumonia in their stock of monkeys shipped from Manila to Washington. This may easily and perhaps correctly be interpreted as indicating a lowering in the general resistance of the animals during the vicissitudes of trans-Pacific transportation.

In the development of pneumonia, either spontaneously in man or experimentally in monkeys, one point lies largely in the field of conjecture. As demonstrated very clearly by Blake and Cecil, monkeys inoculated in the nose and throat with a spray of virulent type I pneumococci become carriers of this type for at least several weeks, but without the slightest effect on their general health. In very striking contrast to this result, those investigators found that a healthy monkey developed a type I pneumonia when merely placed in the same cage with two monkeys ill with a type I pneumonia. It is difficult, at present, to explain why mere contact produces pneumonia, whereas thorough spraying of the upper respiratory tract, resulting in the establishment of the carrier condition, fails entirely to produce the disease.

TABLE 2.—*Intravenous injection of monkeys with pneumococci and intratracheal injection of sterile material.*

Serial No.	Weight.	Intravenous injection of living broth culture.	Intratracheal injection.		Result.
			Material.	Time.	
	g.	*cc.*			
3	2,100	0.5			Died second day.
4	1,850	0.5			Ill, recovered.
25	1,920	1.			Died third day.
26	2,100	1.			Died second day.
27	1,600	0.5			Died third day.
28	2,350	1.	1 cc. sterile broth	12 minutes after intravenous injection	Do.
29	1,550	1.	do	15 minutes after intravenous injection	Died second day.
30	1,600	1.	do	20 minutes after intravenous injection	Do.
33	1,670	0.5	1 cc. dead pneumococci in broth	2½ hours before intravenous injection	Died fourth day.
34	1,560	0.5	do	do	Ill, recovered.

TABLE 3.—*Subcutaneous injection of monkeys with pneumococci.*

Serial No.	Weight.	Broth culture.	Result.
	g.	*cc.*	
14	1,820	0.01	Remained well.
15	1,750	0.01	Do.
16	1,770	0.1	Do.
17	1,800	0.5	Do.
31	1,600	0.5	Ill, recovered.
32	1,570	0.5	Died during first day; septicæmia.

GROSS PATHOLOGY OF EXPERIMENTAL PNEUMONIA IN MONKEYS

The autopsies were performed for the most part immediately after death, or on animals which were sacrificed carefully with ether. In one instance after intratracheal inoculation, death occurred during the night and the autopsy was done the following morning. Cultures were made usually from the heart blood, and in each instance where the gross findings indicated a septicæmia a growth of the pneumococcus was obtained. The spleen, kidneys, liver, suprarenals, and lymphatic glands showed only the usual signs of septicæmic infection, such as hyperæmia and fatty degeneration. Punctiform hæmorrhages were found in the organs mentioned, and also in the serous membranes, more particularly in the pericardium. For the sake of brevity these signs of septicæmia are not always mentioned in the brief protocols that follow, and should be understood as having been present unless otherwise noted.

Interest naturally centers primarily about the findings in the trachea and bronchi, the pleura, and the lungs proper.

All of the monkeys that died after an intratracheal injection of pneumococci showed a definite and often an extensive pneumonia. The right lower lobe was involved with surprising regularity, having been affected in nine of ten animals. The middle and upper lobes on the right side frequently showed more or less extensive pneumonia and occasionally the left lung was involved. The exact distribution is shown in the accompanying chart, fig. 1.

Grossly, the trachea appeared entirely normal, and there was no evidence of any injury at the site of inoculation. The large bronchi in the affected parts of the lungs contained frothy liquid, but the mucous membrane was normal in appearance. In the lungs, extensive consolidation was found, beginning always around the hilus and often involving one-half to three-fourths of a given lobe. At times the entire lobe, except the extreme outer margin, was consolidated, giving the appearance of a firm lobar pneumonia. The pleura had lost its natural shiny luster, and a fairly adherent fibrinous membrane had developed over that portion of the lobe immediately surrounding the hilus. In every case where localized circumscribed pleurisy was found, it was noticed that the real hepatization of the central portion of the lobe had reached the pleura. Fibrinous pleurisy, therefore, corresponded with the topography of the real hepatization, on the parts of pleura nearest to the hilus; that is, on the posterior convexity of the upper part of the lower lobe, the lower part of the upper lobe, and in the interlobar sulcus.

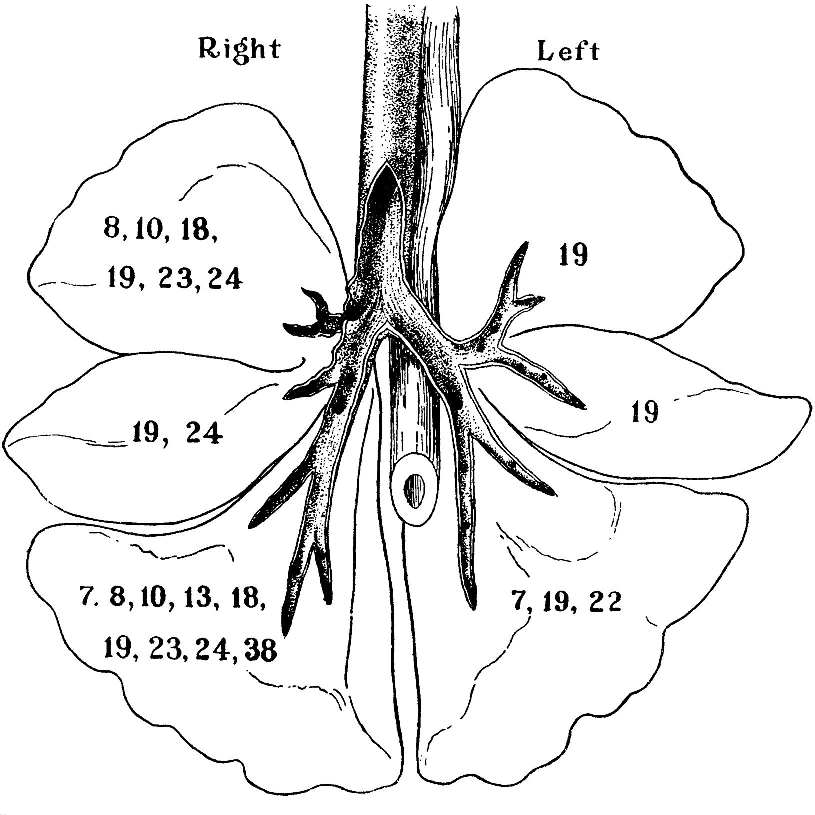

FIG. 1. Diagram showing the distribution of pneumonia in the various lobes of the lung. The serial number of each monkey is placed in the lobes in which pneumonia developed.

On section through the consolidated area, the tissue appeared to be homogenous and of a reddish gray color. Although the color was slightly mottled, we were impressed at first sight by the diffuse hepatization, such as is seen in lobar pneumonia in man. However, after the cut lobe had been allowed to stand for some time, a thick coffeelike liquid escaped and then, more clearly than before, the individual or confluent foci became distinguishable around the hilus. The surfaces of these foci were granular, and projected above the slightly collapsed surrounding tissue, making a distinct impression of bronchopneumonia—rather confluent at times, it is true, but in the confluent areas distinct lobular foci could be seen. It was the extreme œdema involving the major part of the lobe that created the impression of lobar pneumonia. In no case in our series was real red or gray hepatization found to involve either the major part of the lobe or the entire lobe.

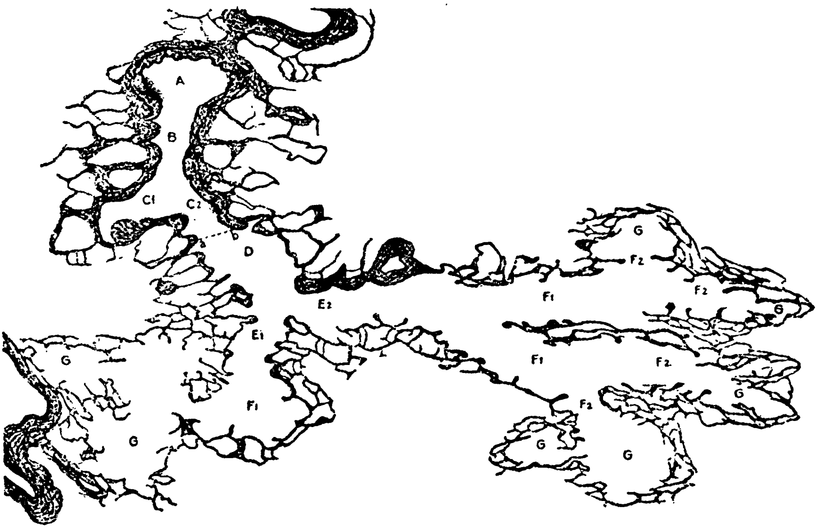

FIG. 2. Schema of air passages. B, terminal bronchiole; C1, C2, respiratory bronchioli of the first order; D, respiratory bronchioli of the second order; E1, E2, respiratory bronchioli of the third order; F1, F2, alveolar passages of the first and second orders; G, alveolar sacs (infundibulum). [From K. Husten, Ziegler's Beiträge 48 (1921) 508.]

The microscopic findings will further elucidate the differences between the hepatization proper and the œdematous areas.

HISTOLOGICAL FINDINGS IN MONKEYS INFECTED WITH PNEUMOCOCCUS

Throughout this work the terminology of Husten(11) is used in referring to the anatomy of the air passages. The chart (fig. 2), taken from Ziegler's Beiträge, illustrates well the details of the relationship between the terminal respiratory bronchioli and the alveolar passages and sacs in the normal lung. Through a fortunate coincidence, a section of one of the pneumonic lesions from one of the monkeys in our series (Plate 1) corresponds closely with this illustration from Husten as given by Harkavy.(9)

For histological study, the tissues were fixed in Zenker's fluid, embedded in paraffine, and stained with hæmatoxylin and eosin.

Although the trachea and the large bronchi appeared normal upon macroscopic examination, distinct changes were found microscopically. In the trachea there was no exudate in the lumen, but there was considerable cellular infiltration in the mucosa and submucosa. This infiltration was particularly pronounced on the posterior part of the trachea reaching deep into the tissue between the trachea and the œsophagus. In the large bronchi below the bifurcation in the portions of the lungs affected, there was a distinct cellular infiltration of the mucosa and the submucosa. This cellular exudate consisted principally of polymorphonuclears, the eosinophiles being well represented. The infiltration penetrated well into the peribronchial tissue through the spaces between the cartilages. Emigration of polymorphonuclears occurred within the epithelial layer of the bronchi and also on the surface of its mucosa, but the exudate was scanty in the lumen as far as the small bronchi and bronchioli. The bronchioli in the hepatized parts were distended and filled with polymorphonuclear leucocytes, large mononuclears, and desquamated epithelial cells. In other parts, some of the terminal bronchioli were collapsed. The collapsed terminal bronchioli indicated complete obstruction of the small bronchi, whereas partial obstruction was shown by the distention of the bronchioli and the marginal emphysema.

In complete agreement with the macroscopic appearance, we found microscopically that the most pronounced hepatization was located at the hilus of the lungs, particularly on the right side corresponding with the first and, eventually, the second branch of the right bronchus. Here the hepatization, noticed on macroscopic examination, was due to the presence in the alveoli of polymorphonuclears, large mononuclears, and a few red cells. The polymorphonuclear cells predominated. A certain number of alveoli in this area, showing gray hepatization, were filled or plugged with fibrin containing a few cells. These areas of gray hepatization evidently represent the most advanced changes and are found usually around the hilus. Adjacent to these areas were foci showing engorgement of the blood vessels and increase of leucocytes in the alveolar septa. Here the alveoli were filled predominantly with red cells and some fibrin. Further, toward the periphery of the lobe, extensive areas were found corresponding with the macroscopically consolidated areas, which were livid gray, and which collapsed upon section, due to the oozing out of thick œdematous fluid. These areas showed the presence of œdema and a few polymorphonuclears in the alveoli, engorged blood vessels, and an increased number of polymorphonuclears within the alveolar septa. Within this area there were sporadic and disseminated foci of inflammation around the pulmonary blood vessels consisting mostly of a polymorphonuclear exudate. The œdematous area not only surrounded the truly hepatized foci, but also intersected them. Usually the pleura showed merely a slight fibrinous and cellular exudate, limited to the areas adjacent to the hepatization. However, in the cases where extensive hepatization had reached the surface, the overlying pleura was covered with a thick fibrinous pseudomembrane.

The liver in all cases showed engorgement and considerable fatty degeneration. The engorged kidneys showed small punctiform hæmorrhages, particularly in the pyramids, but also in the glomeruli. Microscopically the spleen showed engorgement of the blood vessels.

DISCUSSION OF THE PATHOGENESIS OF EXPERIMENTAL PNEUMOCOCCUS PNEUMONIA IN MONKEYS

In analyzing the autopsy records of the monkeys infected with pneumococcus, we can see that the incidence of pneumonia is high following intratracheal inoculation. Pneumonia developed in no instance after the intravenous injection of the culture alone or after intravenous injection of the culture combined with an intratracheal injection of sterile material. This leads us to believe that the pathologic changes in the lungs encountered in the positive monkeys are not of hæmatogenic origin. The combination of the intravenous injection and the intratracheal inoculation of sterile fluid gives further experimental proof for this supposition, because it eliminates the factor of mechanical injury to the lung by the presence of a considerable amount of liquid. Of the three methods employed in the inoculation of monkeys, the intratracheal injection was the only one that was successful. Although the incidence of pneumonia is rather high, variation in the extent of the lesions is considerable and cannot be explained by the duration of the infection. Monkeys autopsied shortly after infection showed at times more extensive lesions than did others examined much later.

However, there is a definite consistency in the location of the lesions encountered in the lungs of the infected animals. As already noted, the process begins near the hilus of the lung, very commonly in the lower portion of the upper right lobe and in the upper portion of the lower right lobe. This occurrence can be explained by the anatomical conditions of the bronchi. The right bronchus shows but a slight deviation from the direct course of the trachea; while the left one branches off at a distinct angle. When the culture suspension is injected intratracheally with the animal lying quietly on its back, there being no struggling or coughing, it is obvious that the injected liquid, or at least most of it, will run straight into the right bronchus. The first branch of this bronchus supplies the lower part of the upper lobe and the second branch usually inserts itself into the upper part of the lower lobe. The branches descend posteriorly and there is more chance for the liquid to gravitate into these two branches than to follow straight along the main course of the right bronchus to the lower part of the lower lobe. The inoculum trickles by gravity down the trachea, through a comparatively narrow river bed, as it were, and with but little force behind it. Therefore, after passing the bifurcation of the lobe's bronchus, the inoculum will spread out over the suddenly widened surface of the branches of the bronchial tree nearest to the bifurcation of the bronchus instead of following one small bronchus, one bronchiolus, and so on, to the pleural part of the lung. This explains the constant findings of a central location of the most-advanced lesions in experimental pneumonia.

However, one case was encountered (see text fig. 1) in which the left lung alone was affected, and there were cases in which both the right and the left lungs showed pneumonia. This may have been due to the change of the position of the animal shortly after the injection had been completed and the animal was placed in its cage.

The general course of the larger bronchi is included in the diagram showing the distribution of pneumonia in the lungs (see text fig. 1). In the animal, from which the diagram was drawn, it happened that the second branch of the right bronchus entered directly into the middle lobe, rather than the lower lobe, instead of following the usual topography as shown on the left side in the diagram.

As to the pathogenesis of the experimental pneumococcus pneumonia in monkeys, the macroscopic evidence permits only a supposition. Further proofs locating the paths through which the infection progresses must be sought in the microscopic findings.

For the interpretation of the microscopic findings we have depended on the histopathologic changes encountered, rather than on the presence or absence of pneumococci in the various parts of the lungs Unless a large series of animals is sacrificed at short intervals of time, commencing very soon after the inoculation has been performed, the presence or absence of bacteria in the lumen of the air passages and the various tissues may be misleading. In other words, one cannot, because no pneumococci are found there on examination at some specified time after injection, exclude a certain portion of the air passages as the portal of infection. The histopathologic changes, on the other hand, show the path through which the bacteria or their products have traveled or are traveling. Furthermore, they are the manifestations of the disease being studied.

From the microscopic findings in the sections, more clearly than from the macroscopic, the impression is gained that, no matter how extensive the change in one and the same lobe may be, there are always noticeable successive changes of propagation. It is clear, from the character of the hepatization proper, that the changes have taken place successively rather than simultaneously. There are, it is true, rather extensive areas about the hilus of the lung, at times, of a uniform degree of hepatization. On the other hand, one encounters areas of gray hepatization, separated from each other by areas of red hepatization or by areas where the alveoli are filled with œdematous liquid and a few cells only. This succession of various stages of hepatization is responsible for the mottled appearance of the affected lungs. Within the œdematous areas at the periphery of the actual hepatization are encountered smaller and larger areas of perivascular cellular infiltration which coincide remarkably with the location of the coniotic deposits. Evidently the infection follows the same paths as do inert bodies. On microscopical examination, the peritracheal tissue shows cellular infiltration, as do the large and the small bronchi in the areas affected; this shows that the inflammatory process has commenced in the bronchi, has gradually involved the peribronchial tissue, and has followed the lymphatic spaces. We see at times involvement of even the mucous glands of the large bronchi. The small bronchi and the terminal bronchioli show distinct purulent contents within the hepatized areas.

To what extent these changes are to be attributed to the septicæmic stage of the infection can be ascertained only by a study of the pathological changes in the lungs of animals infected by intravenous injection.

This much can be said a priori; that, although the pneumonia was accompanied by a pneumococcus septicæmia, the bronchi, both large and small, are intact in the parts of the lung that remained free from consolidation, and there is no perivascular or peribronchial infiltration, althouh engorgement of the vessels is often present.

Sections made from the lungs and other organs of monkeys infected by intravenous injection with highly virulent pneumococci showed more or less pronounced engorgement of the lungs, and in certain cases capillary hæmorrhages into the alveoli. The bronchi, both large and small, as well as the peribronchial and the perivascular spaces were found to be normal in every case. On the other hand, the changes in the liver, kidneys, and spleen after intravenous injection were identical with the changes encountered after intratracheal injection.

From the microscopic findings in the lungs of monkeys infected by intravenous injection certain changes found in the lungs of monkeys infected by intratracheal injection can be eliminated. First, it is seen that the pathological changes in the bronchi, both large and small, and the perivascular and peribronchial infiltration as well as the interstitial infiltration of the alveolar septa are due to the intratracheal or intrabronchial invasion. The diffuse engorgement of the capillaries, which is more or less pronounced over the entire lung, is evidently to be attributed to the septicæmic stage of the infection.

Thus, we have a complicated process in the lungs of the monkeys infected by intratracheal injection. The primary infection involves evidently the tracheobronchial system, the inflammation becoming the more pronounced the farther down we go from the trachea to the terminal bronchioli. From the terminal bronchioli the inflammatory process extends directly to the alveolar passages, the alveolar sacs, and the corresponding alveoli. In addition to this mode of propagation, the inflammatory process extends from the mucous membrane of the air passages into the surrounding perivascular lymphatic spaces and progresses along these beyond the original focus of hepatization. This is clearly seen in the peripheral œdematous areas. The peribronchial lymphatics, draining in the opposite direction, eventually carry the infection to the blood stream.

The air passages in the areas of advanced hepatization show a high degree of inflammation, while in other unaffected areas they are normal and in the œdematous zone they show peribronchitis accompanied by distinct perivascular and alveolar interstitial infiltration. This peribronchial and perivascular inflammation is no doubt of local lymphatic origin because the lumen, and the mucous membrane proper, of these bronchi do not contain any exudate.

It is important to determine the site from which the inflammatory process extends from the respiratory passages to the lymphatic spaces. Blake and Cecil(3) conclude that this happens somewhere in the large bronchi in the hilus of the lobe rather than in the terminal bronchioli or the alveolar passages, though they could not definitely exclude the terminal air passages. Permar,(14) on the other hand, clearly describes injuries in the respiratory passages of rabbits inoculated intratracheally with pneumococci. Histologic examination of our material leads us to believe that definite and destructive injuries to the wall of the air passages took place in the terminal respiratory bronchioli. These injuries were much more severe anatomically than any that were encountered in the large and small bronchi, where the anatomical structure of the wall presents a more formidable defense than in the terminal respiratory bronchioli. Furthermore, the close association of the respiratory bronchioli with the pulmonary blood vessels, from which they are separated by a thin layer of fibrous tissue, facilitates the direct extension of the inflammatory process into the perivascular lymphatics, from the respiratory bronchioli, through injured walls of the latter. Plate 4 illustrates well the pathogenesis of the perivascular lymphangitis in pneumonic lungs. This finding naturally does not exclude the large bronchi as an additional route, in as much as bronchi of considerable size, and even the trachea, show inflammation of the lymphatics in their mucosa and submucosa; but this is one of the manifestations of tracheobronchitis, a disease which does not necessarily lead to pneumonia. On the other hand, it is difficult to believe that an ulcer in the respiratory bronchioli, the base of which involves the perivascular lymphatics of the pulmonary blood vessels, could exist without inducing perivascular lymphangitis.

Müller,(13) as early as 1902, experimented with spontaneous aspiration pneumonia on vagotomized animals and expressed an interesting view regarding the pathogenesis of pneumonia. He concluded that infection of the lungs through the bronchial walls does not occur, but that the primary process enters the terminal alveoli through the walls of the respiratory passages and sacs where the epithelium becomes flattened. (Compare with Plate 4.) This author considers that the extension of the primary process over the lobe takes place through the septa and invades secondarily the lumen of the alveoli. If the inoculum were placed in the respiratory system under such conditions that the virulent pneumococci would be uniformly distributed over the mucous membrane of all the branches of the bronchus supplying one lobe, it is conceivable that a confluent hepatization over the entire lobe or over a major part of it would result and that it would be indistinguishable from the findings in lobar pneumonia in man. As it is, the striking feature of experimental pneumonia in monkeys is the perivascular and interstitial inflammation, a feature which is not pronounced in human lobar pneumonia. This difference between human and experimental pneumonia was pointed out by Permar.(14) Therefore, the interpretation as given by Permar of the pathogenesis of experimental pneumonia produced by intratracheal injection in rabbits applies equally to monkeys.

The differential points between broncho-pneumonia and lobar pneumonia in man are usually given as quantitative and qualitative. The quantitative differences refer to the extent of the lung tissue involved. The process as seen at autopsy usually involves the major part or the entire lobe. More than one lobe may be similarly affected. In broncho-pneumonia one sees distinct, more or less scattered, or even confluent foci. Pleurisy accompanying broncho-pneumonia is not a typical finding, nevertheless; the pleura may be involved if the broncho-pneumonic foci have reached the subpleural regions. The qualitative differences usually given for differentiation of the two types of pneumonia are that the hepatization in lobar pneumonia is simultaneous in the same lobe while in lobular pneumonia the hepatization shows successive genesis in the foci of the same lobe. Furthermore, the greater amount of fibrin encountered in lobar pneumonia is taken as a differential point, as compared with its scantiness in lobular pneumonia. There is no doubt that prototypes of both forms of pneumonia can be differentiated by macroscopic examination with ease, but not infrequently there are cases where it is rather difficult to differentiate between confluent broncho-pneumonia and lobar pneumonia. This is especially true if we consider that the specific organism of lobar pneumonia frequently produces broncho-pneumonia. It seems that certain views expressed in the literature are becoming more and more generally accepted; for example, that the difference between the two types of pneumonia depends on the virulence of the pneumococcus on the one hand, and on the resistance of the animal body on the other. This relation between the invading organism and the resistance of the host constitutes a balance which may swing toward one side or the other.

Thus, in man, infections with the pneumococcus may result merely in a carrier state, or in bronchitis, in broncho-pneumonia without septicæmia, or typical lobar pneumonia with septicæmia.

Müller(13) states that the extent of the lesion depends on the virulence of the invading microörganism; thus, by confluence, a broncho-pneumonia may become lobar. It must be borne in mind that the distinction between broncho-pneumonia and lobar pneumonia was originally based on macroscopic findings alone long before the etiology was known and recognized. Microscopically there are histologic differences which substantiate this differentiation. Subsequent investigations in etiology have shown that lobar pneumonia in man is caused almost always by the pneumococcus, whereas broncho-pneumonia may be produced by a variety of microörganisms. The early septicæmic stage in lobar pneumonia led to the belief that it is of hæmatogenic origin, whereas broncho-penumonia was claimed to be of bronchogenic origin, mainly because of the failure to demonstrate a septicæmia. Experimental evidence, however, did not corroborate the theory of the hæmatogenic origin of lobar pneumonia. The results reported by many investigators make the hæmatogenic origin of a pneumococcus pneumonia of any kind highly improbable. Indeed, we may consider that this phase of the problem has been solved. The exact decision as to whether lobar pneumonia or broncho-pneumonia has been produced in experimental animals becomes in some respects a minor question. This evidence of the bronchogenic origin of both lobar and broncho-pneumonia confirms the older views of Bezzola and Ribbert.(1) The study of experimental pneumonia we believe not only has solved this phase of the problem, but has added in other ways much to the knowledge of the pathogenesis of pneumonia in man. Present-day opinion concerning the pathogenesis of pneumococcus lobar pneumonia is tending more and more to the conception that the difference between lobar pneumonia and broncho-pneumonia is merely one of degree.

SUMMARY OF THE PATHOGENESIS OF EXPERIMENTAL PNEUMOCOCCUS PNEUMONIA

The pathogenesis of experimental pneumococcus pneumonia from the standpoint of gross pathology and histopathology has been studied in Philippine monkeys while in their natural climatic environment.

The finding of Blake and Cecil, that the pneumonic lesions as produced by intratracheal injection of virulent pneumococci type I commences and is most pronounced and frequent around the hilus of the lobe, has been corroborated. The anatomical structure of the bronchial tree and the position of the experimental animal during the inoculation is given as an explanation of this finding as well as of the frequency of gross lesions in the right lung, in the lower part of the upper, and the upper part of the lower lobe.

The view of Blake and Cecil, Permar, Winternitz and Hirschfelder,(18) and other investigators, that pneumonia is of bronchogenic and not of hæmatogenic origin, has been experimentally confirmed. The factor of mechanical injury to the lungs in our work, as caused by the injection of sterile fluid into the trachea, has been eliminated in as much as this procedure failed to induce hæmatogenic pneumonia in conjunction with intravenous injections.

In the histopathologic study of experimental pneumonia, special attention has been paid to the air passages, these being the conveyors of the inoculum. It has been shown that the inflammatory process of the air passages commences in the lower trachea and extends to some of the bronchi and their corresponding bronchioli. The direct extension of the inflammatory process has been demonstrated in one continuous longitudinal section through these elements of the lung, from a terminal bronchiolus to the respiratory bronchioli, further to the alveolar passages, and into the alveolar sacs as well as into the alveoli. This process is considered to be the primary pneumonic lesion.

The extension or propagation of the pneumonic inflammatory process by means of the perivascular lymphatics and the alveolar septa has been demonstrated, confirming the findings of Blake and Cecil; but, in contrast to their interpretation, we regard the perivascular lymphangitis with consequent interstitial pneumonia and subsequent invasion of the alveoli as the secondary rather than the primary process.

A severe ulcerative process has been shown to exist in the respiratory bronchioli where the wall and the epithelium are anatomically reduced, confirming the findings of Permar. This ulceration has been shown to involve directly the adventitia of the adjacent blood vessels. Thus the pathogenesis of the perivasculitis and, consequently, the pathogenesis of the interstitial pneumonia and the lobar appearance of the experimental lesion have been explained.

The peribronchial lymphangitis of the large and the small bronchi is considered as the ways and means responsible for the state of septicæmia rather than as a great factor in the pathogenesis of the experimental pneumonic lesions.

INTRATRACHEAL INOCULATION AS AN EXPERIMENTAL METHOD IN THE STUDY OF PNEUMONIA

It is entirely possible that the intratracheal inoculation may yield a valuable experimental method for the study of pneumonia entirely apart from the exact type of lesion that is produced. The analysis of the data available at present, though perhaps hopeful, indicates nevertheless that a satisfactory method has not yet been established. The objects of experimentation being extremely varied, it is not wise to define too minutely the criteria which should be fulfilled by an experimental pneumonia. For the purpose of studying prophylactic and curative treatment it is desirable that the animals should develop pneumonia with reasonable constancy and with more or less approach to uniformity regarding the course of the disease. In our own work, the injection of normal monkeys under apparently uniform conditions yielded results that varied capriciously, from no apparent effect to acute death in less than twenty-four hours. Judgment concerning the effect of any preventive treatment would have required a cumbrously extensive series of animals. A somewhat similar embarrassment has been noted by Blake and Cecil. For example, in the Philippine monkeys that developed pneumonia after injection of a type I culture, the course of the disease was by no means predictable. In their work the extreme limits in fatal cases varied between two and thirty-seven days. In view of the marked variation in the course of pneumonia, as the disease is seen in man, it is interesting to note that this variation is reproduced in animals. Indeed, it is not surprising that it becomes difficult to do away with this variation by artificial methods. Nevertheless, this inherent variability complicates the experimental procedure.

SUMMARY

1. In the examination of Philippine monkeys (*Pithecus philippinensis* Geoffroy), three of thirteen healthy stock animals were found to be carriers of typical but avirulent pneumococci.
2. Ten of nineteen monkeys developed pneumonia after intratracheal inoculation with 1 cubic centimeter of a young broth culture of a type I pneumococcus highly virulent for mice.
3. Experimental evidence is presented which shows that pneumonia is of bronchogenic and not hæmatogenic origin.
4. The topographic distribution of experimental pneumonic lesions following intratracheal inoculation is explained by the anatomic structure of the monkey's bronchial tree and by physical laws.
5. The pathogenesis of experimental pneumonia in monkeys is explained as primarily a broncho-pneumonia and, secondarily, as an interstitial inflammation. Extensive ulceration in the terminal air passages is followed by perivascular lymphangitis which, in turn, is responsible for the interstitial pneumonia.
6. With respect to the pathogenesis and the histopathologic findings, there is no fundamental difference between experimental pneumonia in monkeys and that in rabbits.

AUTOPSY RECORDS

The following protocols give the essential findings in the monkeys that developed pneumonia after intratracheal inoculation, and also show some examples of the typical effects produced by the intravenous injection of pneumococci.

NO. 7, INTRATRACHEAL INJECTION. DIED IN SEVENTY-SEVEN HOURS

The lungs are free. The lower lobes on both sides show extensive consolidation. The pleura of both lower lobes is dull in the upper posterior part. Distinct mottling noticeable in the upper part of both lower lobes while the lower parts of the same lobes are of a diffuse livid color and the margins are emphysematous.

Upon section there escapes from the cut surfaces a considerable amount of liquid. The bronchi are filled with thin frothy liquid. Due to the oozing out of the liquid the greater part of the tissue gradually collapses. The upper fourth of the right lobe and the upper sixth of the left lobe are hepatized and do not collapse. The cut surfaces are granular, presenting confluent hepatized patches, some red and some gray.

NO. 8, INTRATRACHEAL INJECTION. SACRIFICED AFTER NINE DAYS

The lungs are free, the surface smooth, slight adhesion between the upper and the lower lobes. No liquid in the pleural cavities. At the hilus of the right lung there is a palpable consolidation of the lower part of the upper lobe and the upper part of the lower lobe. Upon section the consolidated area in the upper lobe (1 by 1 centimeter) and in the lower lobe (1 by 0.5 centimeter) is solid but rather elastic and of a grayish brown color. The surface of the section is granular and the pleura over the area is thickened.

NO. 10, INTRATRACHEAL INJECTION. FOUND DEAD IN LESS THAN FORTY-EIGHT HOURS

Considerable involvement of the right lower lobe (see Plate 1). The lower portion of the upper right lobe is consolidated. Upon section the central part shows hepatization, extending almost to the surface. The pleura shows no exudate.

NO. 13, INTRATRACHEAL INJECTION. SACRIFICED AFTER THREE DAYS

In the upper part of the right lower lobe posteriorly a small consolidated area was found. The pleura is smooth and shiny. Upon section a grayish focus with granular surface was found in close proximity to a small bronchus and a blood vessel. Surrounding the focus is tissue of gelatinous appearance. Upon pressure there escapes from the lung tissue of this area a thick mucous liquid. Rest of lungs normal.

NO. 18, INTRATRACHEAL INJECTION. SACRIFICED AFTER FORTY-EIGHT HOURS

Left lung is normal. Of the right lung the lower posterior portion of the upper lobe and the posterior upper portion of the lower lobe are solid. The pleura is smooth, shiny, and dark purplish over the consolidated area; otherwise normal. On the periphery of the dark purplish discolorization of the pleura punctiform hæmorrhages are plainly discernible.

Upon section the affected area shows a granular surface; it is solid and does not collapse. Upon pressure there escapes a thick œdematous liquid containing a few large air bubbles. The hepatization is gray in some parts and red in others, the entire consolidated area being distinctly composed of confluent foci, some of which show gray and others red hepatization. The confluent consolidated areas, both in the upper and in the lower lobes, are located directly at the hilus of the lungs. The upper and the lower lobes show marginal emphysema and considerable œdema in the parts adjacent to the consolidation.

The trachea and the large bronchi appear normal. From the first and the second branches of the right bronchus, which lead directly to the consolidated areas, a thin œdematous frothy liquid escapes. The middle lobe is normal.

NO. 19, INTRATRACHEAL INJECTION. DIED IN TWENTY-SIX HOURS

The right pleural cavity contains at least 0.5 cubic centimeter of thick, cloudy, mucous liquid. The lower portion of the trachea and the bronchi are filled with thin, frothy liquid.

The right lung.—The upper lobe is emphysematous. On the anterior surface of this lobe a hæmorrhagic focus is visible through the pleura reaching from the convexity almost to the anterior margin of the lobe.

The middle lobe is consolidated at its hilus and throughout the entire lobe, leaving only the margin of the lobe and the top free. The consolidated part of the lobe is purple, and reaches through the entire thickness of the lobe. The margin and the upper part of the lobe show well-developed emphysema.

The lower lobe is affected in its entirety. It is solid and does not collapse. The entire lobe is brownish purple; the edges present a jelly-like appearance and contain plainly visible, engorged blood vessels. Along the lower edge there is moderate emphysema. The upper part of the lower lobe shows red mottling, and the lower part is more uniform in color. The pleura covering the upper part of the lower lobe is dull and is covered with distinct fibrinous membranes. The extent of this fibrinous pleuritis is about 1 by 0.5 centimeter and is located on the convexity and the posterior surface of the lobe. The consolidated part of the lung tissue under this part of the pleura is wedge-shaped, purple, and is surrounded with several small wedge-shaped foci, purple in the center and outlined from the rest of the tissue by a narrow whitish margin, thus simulating an infarct.

The left lung.—The upper left lobe shows changes practically identical with those in the middle right lobe, except that the apex of the upper left lobe is more emphysematous than the apex and the edge of the middle right lobe.

The left middle lobe shows changes similar to those found in the right middle lobe, but of lesser degree.

The lower left lobe is distended and emphysematous. In the posterior upper part and on the diaphragmatic surface there is a red mottling visible through the pleura. The latter is normal. Upon section the tissue of the upper part of the lobe, to an extent of about 1 centimeter, is solid and does not collapse, showing a granular surface of a reddish gray. The rest of the lobe collapses gradually as its œdematous contents escape.

A smear from the pleural exudate shows numerous polymorphonuclears and a few pneumococci.

NO. 22, INTRATRACHEAL INJECTION. SACRIFICED AFTER TWENTY-SIX HOURS

The lungs are apparently normal except the left lower lobe which shows three widely separated foci. They are solid, do not collapse like the surrounding tissue, and are dark purple. Upon section these foci show wedge-shaped hæmorrhagic areas surrounded by œdema. The lung tissue on the surface and along the edges of the lobe is emphysematous.

The pericardial liquid is increased and slightly cloudy. There are numerous epicardial hæmorrhages along the coronary vessels.

NO. 23, INTRATRACHEAL INJECTION. SACRIFICED AFTER SEVEN DAYS

The left pleural cavity contains a clear fluid. Adhesions between the parietal and the visceral pleuræ to the extent of the right lower lobe; also adhesions between the diaphragm and the upper surface of the liver. These adhesions are fibrinous and partly organized. They can be separated but adhere partly to the serous membrane. After removal of the adhesions the surface of the lower right lung is dull, showing distinct mottling over the lower posterior part as well as over the anterior and lower edge of the lower lobe. Practically the entire right lower lobe is consolidated with the exception of its middle margin which is emphysematous. All the rest of the tissue of the lower lobe is solid and without air.

Upon section there escapes from the lung tissue a thick gray liquid containing a small amount of blood, but no air. The surface of the section is granular, gray, with small, dark reddish foci scattered throughout the consolidated tissue. These foci are particularly numerous toward the pleura and are responsible for the mottled appearance of the surface of the lower lobe. The upper and the middle right lobes show distinct emphysema, reaching the bullous stage at the apex. There are few punctiform hæmorrhages in the pleura, but otherwise this is normal. The lower posterior part of the right upper lobe shows consolidation, but the overlying pleura is normal. Upon section a triangular consolidated focus (1 by 1 centimeter) is found in the lower portion of the upper lobe close to the hilus, reaching almost but not quite to the pleura.

The left lung is normal. The mucous membrane of the bronchi below the bifurcation is pale but is covered with a small amount of mucus. Peribronchial glands are enlarged and fleshy in color. Pericardium and epicardium œdematous. A few small hæmorrhages along the coronary vessels.

NO. 24, INTRATRACHEAL INJECTION. SACRIFICED AFTER SEVEN DAYS

A small amount of liquid in the left pleural cavity. The left lung is normal except for a few punctiform hæmorrhages in the pleura.

The right lung.—All three lobes are involved. The pleura of the lower lobe and that of the posterior lower part of the upper lobe are covered with fibrinous freshly organized exudate. The margins of the lobes are free from exudate and emphysematous. The pseudomembranes found on the surface of the pleura can be peeled off fairly easily, leaving a rough dull surface which shows a distinct red mottling. Upon section the consolidated areas reach to the hilus and are of the same character as those in monkey No. 23.

Pericardial fluid increased. Epicardium shows milky thickening along the coronary vessels.

The bronchi.—Below the bifurcation and on the left side there is a thin, frothy liquid. From the right side there escapes a thick, mucous liquid. The mucous membrane is pale. Peribronchial glands are pale.

NO. 25, INTRAVENOUS INJECTION. FOUND DEAD IN LESS THAN FORTY-EIGHT HOURS

The lungs are free. Sanguinolent liquid in both pleural cavities, especially on the left side. The lungs are pinkish in the upper part and livid red in the lower part which was found immersed in the exudate. The entire lung on both sides contains air; there is engorgement but no consolidation.

Pericardial liquid increased and cloudy. Petechial hæmorrhages on the epicardium along the coronary vessels.

NO. 26, INTRAVENOUS INJECTION. FOUND DEAD IN LESS THAN TWENTY-FOUR HOURS

Right lung normal.

Left lung is dark purplish red, elastic, and collapses. Upon section, the surface is normal; a small amount of thin liquid containing air bubbles escapes upon pressure. Otherwise normal.

NO. 27, INTRAVENOUS INJECTION. FOUND DEAD IN LESS THAN FORTY-EIGHT HOURS

Same findings as in No. 25.

NO. 28, INTRAVENOUS INJECTION. FOUND DEAD IN LESS THAN SEVENTY-TWO HOURS

A few old fibrous adhesions between lobes and between the lobes and the diaphragm. In the lower part of the upper and the lower part of the lower lobe there are a few subpleural hæmorrhages, about 2 millimeters in diameter, and the surrounding area is discolorized. No consolidation anywhere in the lung tissue. A slight amount of mucus in the bronchi.

Pericardial liquid is increased; numerous punctiform hæmorrhages in the epicardium.

NO. 29, INTRAVENOUS INJECTION. FOUND DEAD IN LESS THAN FORTY-EIGHT HOURS

Hyperæmia of all organs. Punctiform hæmorrhages in the pericardium, spleen rather firm and small, lungs normal.

NO. 30, INTRAVENOUS INJECTION. DIED IN LESS THAN FORTY-EIGHT HOURS

Hyperæmia of all organs. Punctiform hæmorrhages in the pericardium. Spleen slightly enlarged but firm. In the right middle lobe a small collapsed area; otherwise no change in the lungs.

NO. 38, INTRATRACHEAL INJECTION. DIED IN FIFTY HOURS

Both lungs are free.

The left lung normal, save for a small hæmorrhagic focus the size of a small pea at the lower anterior margin of the lung. A thin, foamy liquid escapes from the large bronchi.

The right lung.—The upper lobe is œdematous, but contains air throughout. Middle lobe normal.

The lower lobe enlarged. The pleura is shiny, slightly turbid in the posterior part. Consolidation of the entire upper part of the lobe and the posterior and the lower part of the lobe, leaving intact only a thin superficial layer of the lung tissue at or about the front margin. The upper part of the lower lobe shows hæmorrhagic foci and mottling and the lower part of the same lobe is more uniform in color—diffusely livid.

Upon section the upper third of the lower lobe is grayish, and small hæmorrhagic foci are scattered throughout this area. The surface is granular, and the tissue in this part of the lower lobe does not collapse. The lower two-thirds of the lobe are also solid; upon section, uniform in color without mottling; an œdematous liquid escapes from the cut surfaces. There are no air bubbles in this liquid. The tissue of the lower two-thirds of the lower lobe collapses gradually as the liquid oozes out, leaving the upper third of the lobe prominent.

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ILLUSTRATIONS

[It should be emphasized that the plates which illustrate the pathogenesis of experimental pneumococcus pneumonia in monkeys are reproductions of histological preparations made from various parts of one section, through the lower lobe of one and the same experimental animal.]

PLATE 1

Section through the lower lobe of the right lung, showing the topography of the lesions. The bifurcation of the main bronchus is shown in the upper left-hand corner of the photograph and the central location of the most-pronounced pneumonic lesions around the hilus of the bronchus is shown. At the periphery of the hepatization there is a zone of more or less pronounced œdematous consolidation and interstitial inflammation. Immediately under the pleura, in the upper right-hand corner, there is a focus which shows distinct emphysema.

PLATE 2

FIG. 1. Cross section through the posterior part of the trachea showing the tracheal mucous membrane on the left and the mucous membrane of the œsophagus on the right. The tracheal mucous membrane is swollen and shows slight infiltration. The infiltration penetrates through the muscularis into the submucosa and between the muscles of the tracheal wall deep into the lymphatics in the dividing line between the trachea and the œsophagus.

2. The bifurcation of the small bronchus is shown in this figure. The lumen of the main small bronchus and its branches is filled with cellular exudate.

3. The final details can be seen in this figure, which is a section of the left branch of the small bronchus shown in fig. 2, under high power. There can be seen numerous polynuclear cells and some large mononuclears, as well as fibrin, filling the lumen. The wall and the epithelium are well preserved, but there is a slight infiltration visible in the membrana propia and in the epithelial layer indicating immigration of leucocytes into the lumen.

PLATE 3

FIG. 1. Showing normal pleura on the left. The lung tissue under the pleura shows various stages of hepatization, the areas in the different stages lying close to one another, indicating that the changes have taken place successively rather than simultaneously. There are alveoli showing œdematous exudate with only a few cells. There are others filled with red corpuscles, which appear as finely granular dark areas. In the exudate filling other alveoli leucocytes predominate and show in the photograph as grossly granular foci.

FIG. 2. A section through the main pneumonic lesions. Here, on the left side, is seen the wall of a large bronchus armed with cartilage. The mucous membrane of this large bronchus is comparatively normal. The hepatization of the adjacent lung tissue is uniform, the exudate consisting of cellular elements.

3. An illustration of the perivascular spreading of the pneumonic process through the lung tissue is seen in this figure.

PLATE 4

FIG. 1. A longitudinal section through the bronchiole, the respiratory bronchiole, and the respiratory passages. The direct continuation of the inflammatory process from the bronchiole through the respiratory bronchiole to the passages and to the terminal alveoli is shown under low power. The bronchiole is situated to the reader's left and in its continuation it runs as a cross line through the photograph. A blood vessel of considerable size is seen in the center and a little below.

2. Showing, in the center of the photograph, the low-power view of the alveolar passages and terminal alveoli seen in fig. 1.

PLATE 5. THE SECTIONS SHOWN IN PLATE 4, BUT UNDER HIGH POWER

FIG. 1. The border line between the respiratory bronchiole and the respiratory passages. The upper part of the picture shows the wall of the respiratory passages fairly intact, and the opposite wall, which runs through the center of the photograph, shows a cuboidal epithelial lining and sudden interruption (in the center of the photograph) of the wall of the respiratory passage. There are a few large epithelial cells scattered in the breach of the wall, indicating the former location of the wall. The cellular exudate found in the lumen penetrates through this breach of the wall and reaches the adventitia of a blood vessel, seen at the lowest margin of the photograph. Thus an ulcer was formed, the base of which rests on the adventitia of the blood vessel which, in turn, shows considerable cellular infiltration.

2. The terminal alveoli and the respiratory sac are shown under high power. The continuation of the respiratory passages, shown in fig. 1, is seen on the left border of fig. 2.

TEXT FIGURES

FIG. 1. Diagram showing the distribution of pneumonia in the various lobes of the lung. The serial number of each monkey is placed in the lobes in which pneumonia developed.

2. Schema of air passages. B, terminal bronchiole; C1, C2, respiratory bronchioli of the first order; D, respiratory bronchioli of the second order; E1, E2, respiratory bronchioli of the third order; F1, F2, alveolar passages of the first and second orders; G, alveolar sacs (infundibulum). [From K. Husten, Ziegler's Beiträge 48 (1921) 508.]

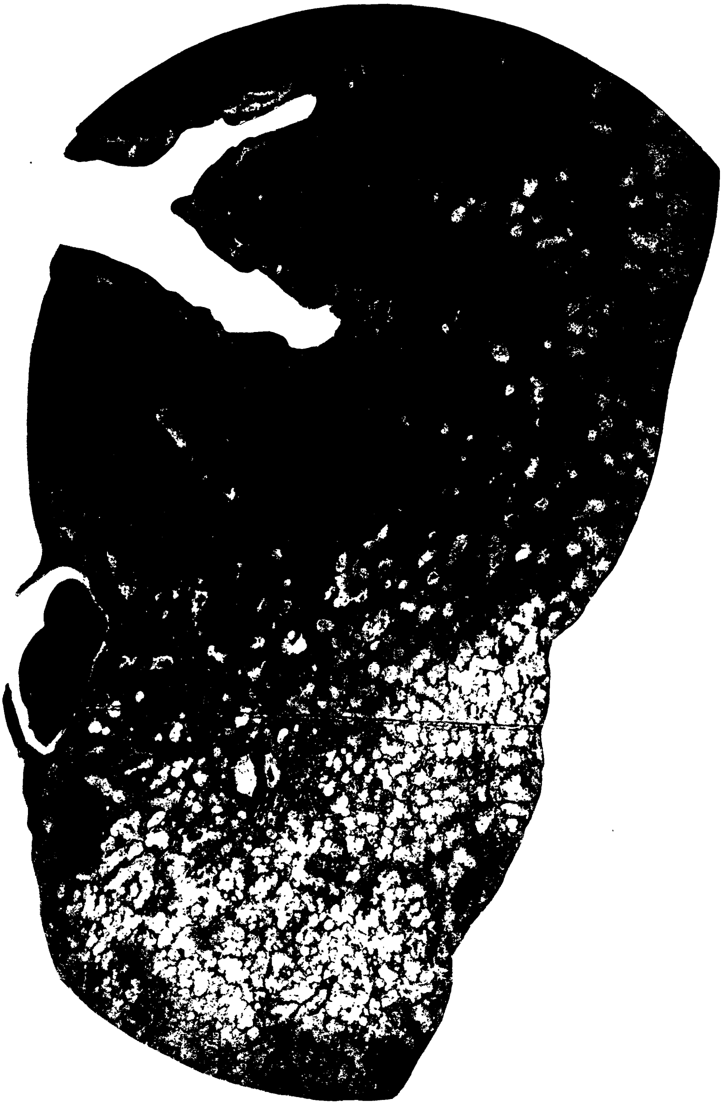
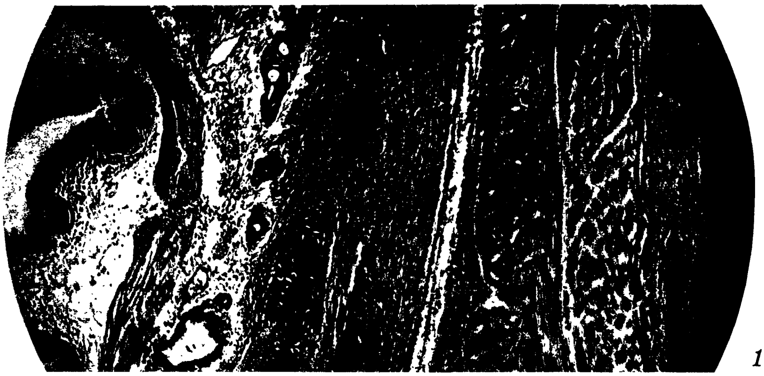


PLATE 1.



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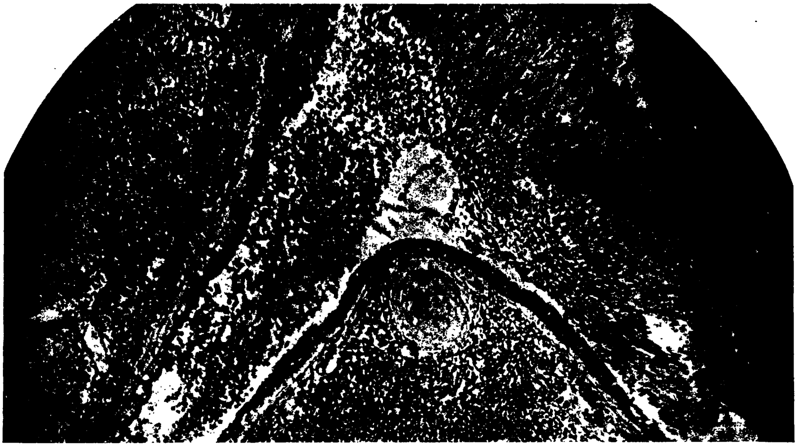

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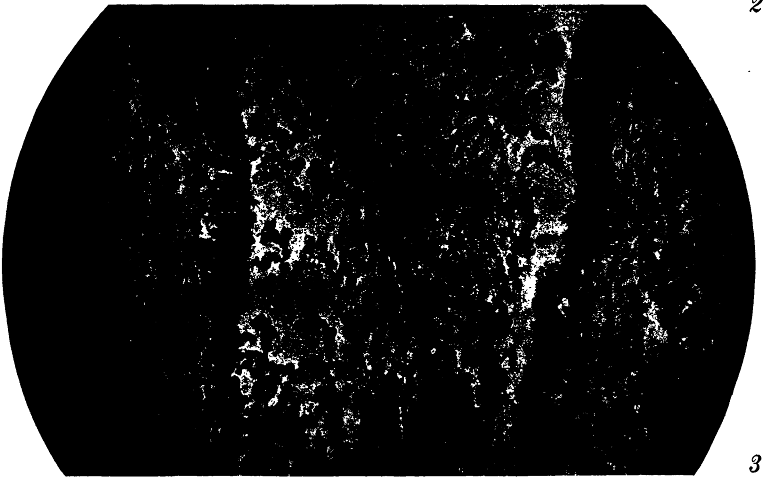

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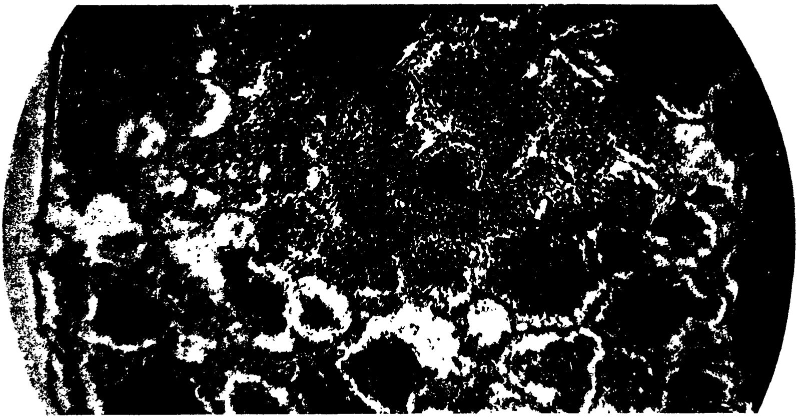
PLATE 2.



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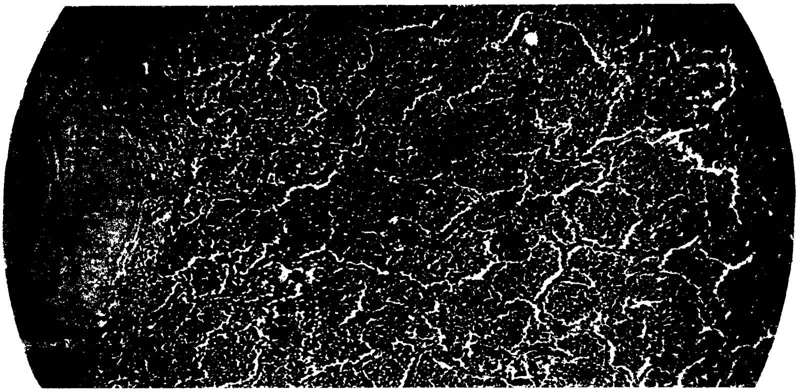

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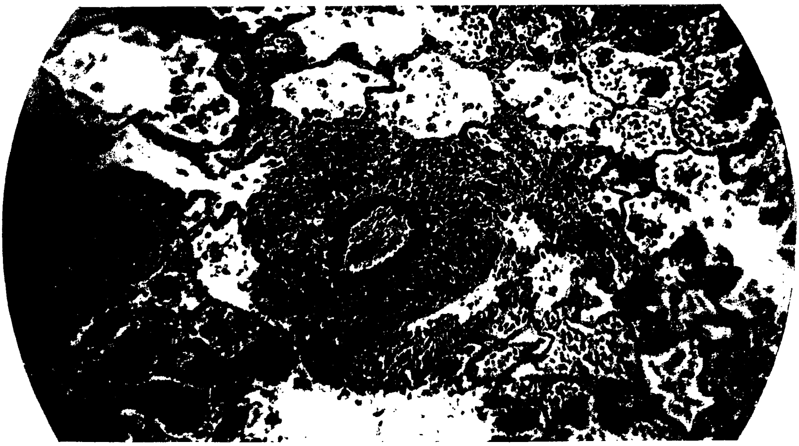

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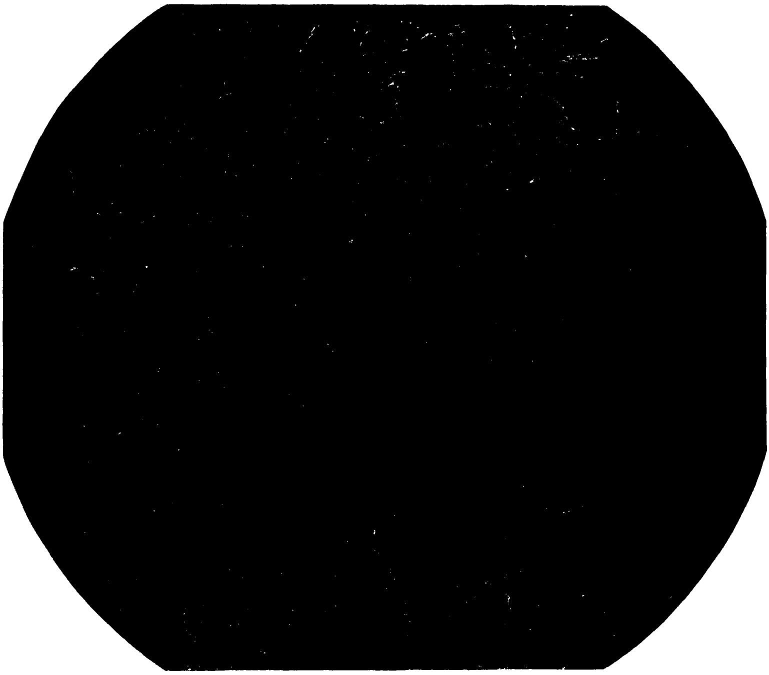
PLATE 3.



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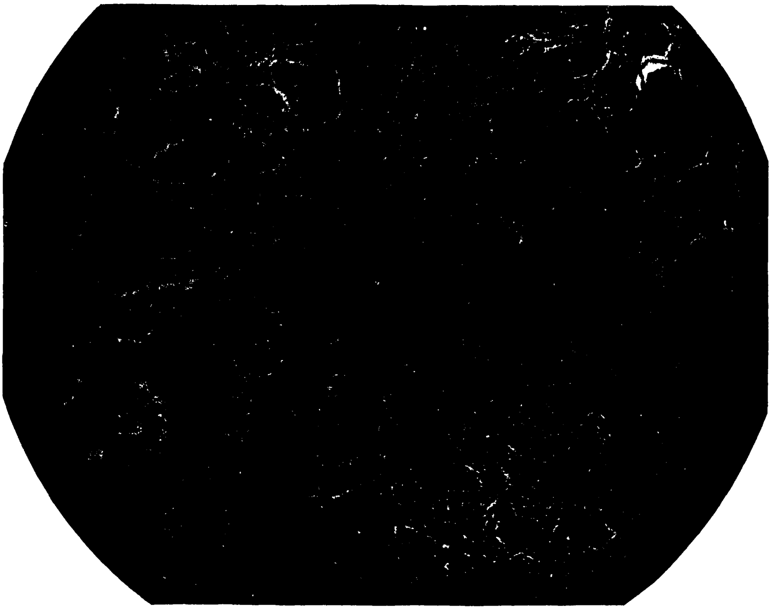

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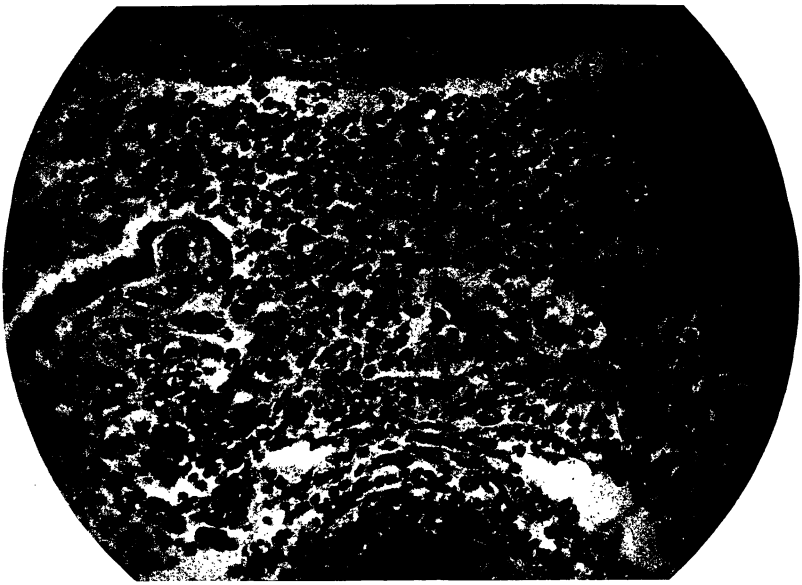
PLATE 4.



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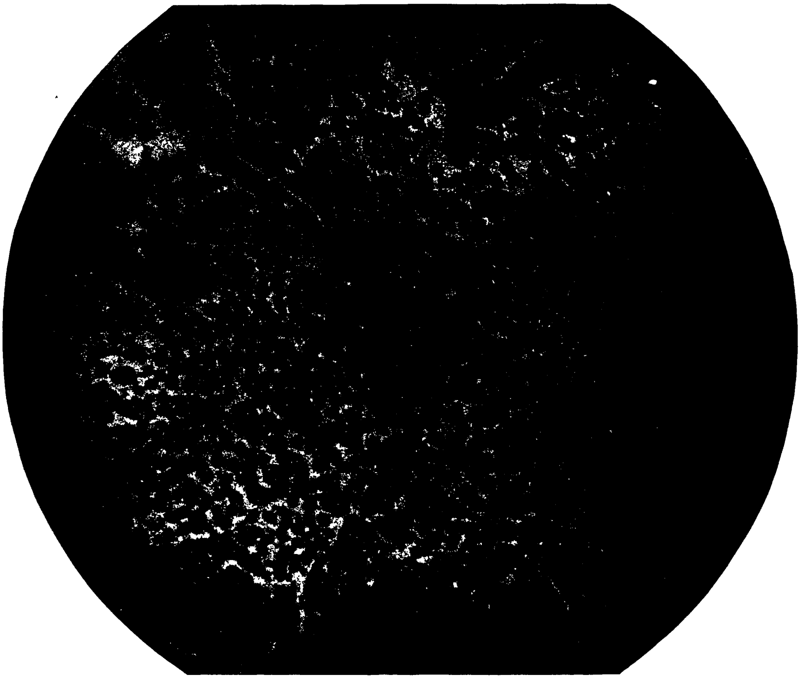

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PLATE 5.

DIE LYCIDEN DER PHILIPPINEN-INSELN

Von R. KLEINE
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VIER TAFELN

Ueber die Lyciden der Philippinen ist noch wenig bekannt. Eine systematische Erforschung der Inseln hat erst in jüngster Zeit eingesetzt. Das von den verschiedenen Forschern erbeutete Material hat einen grossen Reichtum an Arten, aber nur eine neue Gattung erbracht.

Das für diese Bearbeitung benützte Material, etwa 4,500 Individuen, stammt aus folgenden Sammlungen:

Die grosse Ausbeute, die Professor Charles Fuller Baker zusammengebracht hat.
Die ebenfalls grosse Ausbeute Böttcher's aus dem Museum Natura Artis Magistra zu Amsterdam.
Die Sammlung des Bureau of Science zu Manila.
Das Material des Dresdener Museums.
Das Material der Firma Dr. Otto Staudinger und A. Bang-Haas zu Dresden.

Für dauernde Unterstützung habe ich zu danken den Herren Professor Baker, Los Baños; J. B. Corporaal, Amsterdam; Professor Heller, Dresden; und Marquardt, Dresden.

Bis zu dieser Bearbeitung waren folgenden Lyciden bekannt:

1853 beschrieb Blanchard *Ditoneces pilicornis*.
1877 beschrieb Waterhouse *Calochromus orbatus*.
1879 beschrieb Waterhouse *Metriorrhynchus philippinensis* und *Trichalus cyaneiventris*.
1883 beschrieb Bourgeois *Trichalus longicollis*.
1886 beschrieb Bourgeois *Trichalus nigricauda, Ditoneces philippinensis,* und *Ditoneces pusillus*.

Die von Palawan bekannt gewordenen Arten *Lycostomus similis* Hope und *Dihammatus pallens* Waterhouse sind fremde Elemente.[1]

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[1] Die von Pic beschriebenen Arten habe ich, nach dem Vorgang anderer Systematiker nicht berücksichtigt, da die Pic'schen Diagnosen die Erkennung der Art nicht zulassen. Nur soweit Typen vorliegen können Pic's Arten in Zukunft Berücksichtigung finden.

ZOOGEOGRAPHIE

Nach meinen Erfahrungen, die ich in jahrelanger Bearbeitung bei den Brenthiden gemacht habe, sind die Philippinen unbedingt zum austro-malayischen Gebiet zu rechnen. Der papuanische Einschlag, der sich namentlich in der Ausfärbung zeigt ist so bedeutend, dass man die Philippinen als einen abgesprengten Teil Neu-Guineas ansehen könnte. Die Beziehungen zu den Molukken waren sehr gering, dagegen erwies sich als sicher, dass eine Zuwanderung aus dem orientalischen Gebiet stattgefunden hatte. Bei den Einwanderern handelte es sich um grosse, weitverbreitete Gattungen, die zum Teil auf den Philippinen mit ihrer Wanderung zu Ende gekommen waren und keinen Anschluss auf der südöstlichen Zugstrasse über Celebes gefunden hatten. Zum Teil sind es Arten die im indo-malayischen Untergebiet weitverbreitet sind, also eine grosse Migrationsfähigkeit und -geschwindigkeit besitzen. Viele der Zuwanderer wurden auf Palawan festgestellt. Dass die Zuwanderung unbedingt über diese Inseln stattgefunden haben muss ist damit nicht gesagt, ich glaube vielmehr dass der Zustrom im Zuge der Sulu-Inseln wenigstens ebensogross, wenn nicht noch grösser gewesen ist. Leider sind diese zoogeographisch so wichtigen Inseln noch nicht exploriert.

Wie liegen die Dinge nun bei den Lyciden?

Die Verhältnisse liegen nicht ganz einfach. Die Lyciden sind habituell und in der Ausfärbung äusserst einheitlich. Der Farbencharakter Papuas fällt also als Beweismoment fort. Die Philippinen bilden allerdings einen Farbenkreis für sich, der durch starkes Hervortreten orangeroter und dem naheliegender Nuancen dokumentiert wird. Schon Professor Baker machte mich darauf aufmerksam und meinte, dass hierin eine wichtige Differenz gegen Borneo liege. Ich muss dieser Ansicht beistimmen. Aber es lassen sich keine Merkmale finden, die an Papua erinnern und die hellen Farbentöne sind daselbst keineswegs häufig.

Auch die Gattungen in ihrer Verbreitung lassen vollkommen in Stich. Die weitaus meisten Gattungen sind weit verbreitet, wenigstens im orientalischen Gebiet. Nur *Cladophorus* ist sicher von Papua gegen Norden vorgestossen, findet sich auch sonst vereinzelt im orientalischen Gebiet, eine den Brenthiden ganz analoge Erscheinung.

Die artliche Beeinflussung ist von allen Seiten aus sehr spärlich. Verschiedene Orientalen haben auf Palawan halt gemacht, nur eine Art ist bis zu den Philippinen gekommen. Palawan hat sich bei den Brenthiden als scharfe Grenze erwiesen und scheint es auch hier zu sein. Palawan ist der letzte Ausläufer des asiatischen Massivs, die Philippinen dagegen gehören dem papuanischen Gebiet an. Dass ein Hin- und Herwandern über die Sulu-Inseln stattgefunden haben kann halte ich für sicher, denn vereinzelt sind Philippinenlyciden in Nordost Borneo (Sandakan) gefunden worden und es ist nach Massgabe der Individuenstärke anzunehmen dass eine Abwanderung von den Philippinen stattgefunden hat. Borneenser habe ich auf den Inseln nicht gefunden.

DIE VERBREITUNG AUF DEN EINZELNEN INSELN

Von Marinduque, Catanduanes, Burias, Tablas, und Cebu fand ich kein Material vor. Die Verbreitung auf den einzelnen Inseln war folgende. Von 123 mit sicheren Fundorten belegten Arten fanden sich auf:

Luzon	78	Panaon	4
Polillo	4	Bohol	3
Mindoro	15	Dinagat	2
Ticao	1	Siargao	5
Masbate	3	Panay	5
Samar	24	Negros	24
Sibuyan	14	Mindanao	78
Biliran	1	Basilan	16
Leyte	6	San Miguel[1]	7

Die Gattungen sind auf dem ganzen Archipel verbreitet, die Arten natürlich zum Teil mehr lokal. In nachstehender Tabelle ist die Verbreitung der einzelnen Arten angegeben.

SYSTEMATISCHER KATALOG DER PHILIPPINISCHEN LYCIDÆ

Genus **CALOCHROMUS** Guérin Méneville

Calochromus GUÉRIN MÉNEVILLE, Ann. Soc. Ent. Fr. (1833) 158.

Die Gattung ist im ganzen orientalischen Gebiet verbreitet, östlich ist sie bis zum australischen Festland vorgedrungen. Der Gattungscharakter ist fest umgrenzt, auch die philippinischen Arten bleiben im Gattungsmassiv. Mit Ausnahme von *orbatus* Waterhouse dürften alle Arten Endemismen sein.

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[1] San Miguel is a small island off the eastern coast of Albay Province.—EDITORS.

Tabelle der Verbreitung der Philippinen Lyciden-Arten.

	Arten.	Luzon.	Polillo.	Mindoro.	Ticao.	Masbate.	Samar.	Sibuyan.	Biliran.	Leyte.	Panaon.	Bohol.	Dinagat.	Siargao.	Panay.	Negros.	Mindanao.	Basilan.	San Miguel.	Palawan.
1	*Calochromus orbatus* Waterhouse	×		×												×	×			×
2	*Calochromus sororius* sp. nov	×															×			
3	*Calochromus macropalpis* sp. nov	×															×			
4	*Calochromus conveniens* sp. nov	×						×			×					×	×		×	
5	*Calochromus pallidulus* sp. nov																×			
6	*Lycostomus similis* Hope																			×
7	*Lycostomus frivolus* sp. nov	×					×										×		×	
8	*Lycostomus flavotestaceus* sp. nov	×			×									×			×			
9	*Lycostomus pygmaeus* sp. nov	×															×			
10	*Plateros ordinarius* sp. nov	×								×							×			
11	*Plateros contortus* sp. nov	×														×	×	×		
12	*Plateros senex* sp. nov	×					×										×			
13	*Plateros pilosus* sp. nov	×															×			
14	*Plateros luteolus* sp. nov																×			
15	*Plateros generalis* sp. nov																×			
16	*Plateros lepidus* sp. nov						×										×			
17	*Plateros fucosus* sp. nov	×					×			×	×									
18	*Plateros cuneatus* sp. nov	×															×			
19	*Plateros ponderosus* sp. nov	×																		
20	*Plateros luzonicus* sp. nov	×																		
21	*Plateros popularis* sp. nov	×					×													
22	*Plateros fulgidus* sp. nov	×		×			×													
23	*Plateros tenebrans* sp. nov	×		×													×			
24	*Plateros triangulus* sp. nov	×																		
25	*Plateros simillimus* sp. nov	×																		
26	*Plateros contrarius* sp. nov	×		×																
27	*Plateros contextus* sp. nov	×															×			
28	*Plateros conspiciendus* sp. nov							×												

29	*Plateros testaceus* sp. nov.	×															×			
30	*Plateros conspicuus* sp. nov.															×				
31	*Plateros bakeri* sp. nov.						×													
32	*Plateros constans* sp. nov.	×														×	×	×		
33	*Plateros continens* sp. nov.																×			
34	*Plateros fraudulentus* sp. nov.	×								×		×					×		×	
35	*Plateros quadraticollis* sp. nov.																		×	
36	*Plateros fraterculus* sp. nov.	×																		
37	*Plateros contiguus* sp. nov.	×																		
38	*Ditoneces philippinensis* Bourgeois	×															×			
39	*Ditoneces afflictus* sp. nov.	×		×			×									×	×			
40	*Ditoneces consociatus* sp. nov.																×			
41	*Ditoneces consonus* sp. nov.																×			
42	*Ditoneces affinis* sp. nov.	×		×																
43	*Ditoneces alienus* sp. nov.	×																		
44	*Ditoneces promiscuus* sp. nov.																×			
45	*Ditoneces pusillus* Bourgeois															×	×	×		
46	*Ditoneces aestimabilis* sp. nov.																×	×		
47	*Ditoneces conterminus* sp. nov.					×											×	×		
48	*Ditoneces continuus* sp. nov.																×			
49	*Ditoneces pilosicornis* Blanchard																×			
50	*Ditoneces aemulus* sp. nov.																×			
51	*Subdihammatus curvus* sp. nov.	×																		
52	*Dihammatus abditus* sp. nov.						×										×			
53	*Dihammatus abjectus* sp. nov.	×		×															×	
54	*Dihammatus orientalis* sp. nov.	×															×			
55	*Dihammatus pallens* Waterhouse																			×
56	*Libnetis commendabilis* sp. nov.	×															×			
57	*Libnetis gracillimus* sp. nov.																×			
58	*Libnetis bardus* sp. nov.	×																		
59	*Libnetis coloratus* sp. nov.																×			
60	*Libnetis defectus* sp. nov.																×			
61	*Libnetis deductus* sp. nov.																×	×		
62	*Libnetis debilis* sp. nov.	×					×										×			
63	*Dilophotes abnormis* sp. nov.	×						×								×	×			

Tabelle der Verbreitung der Philippinen Lyciden-Arten—Continued.

	Arten.	Luzon.	Polillo.	Mindoro.	Ticao.	Masbate.	Samar.	Sibuyan.	Biliran.	Leyte.	Panaon.	Bohol.	Dinagat.	Siargao.	Panay.	Negros.	Mindanao.	Basilan.	San Miguel.	Palawan.
64	*Dilophotes comes* sp. nov	×														×	×	×		
65	*Scarelus crudus* sp. nov	×															×			
66	*Lyropaeus philippinensis* sp. nov																×			
67	*Metriorrhynchus philippinensis* Waterhouse	×	×			×	×	×	×	×		×	×		×	×	×	×		
68	*Metriorrhynchus croceus* sp. nov																×			
69	*Metriorrhynchus forcipatus* sp. nov	×																		
70	*Metriorrhynchus böttcheri* sp. nov	×																		
71	*Cladophorus fragilis* sp. nov						×									×	×	×		
72	*Cautires coronarius* sp. nov	×														×				
73	*Cautires exploratus* sp. nov	×					×										×			
74	*Bulenides aterrimus* sp. nov	×														×	×			
75	*Bulenides adumbratus* sp. nov	×						×								×	×			
76	*Bulenides adventicius* sp. nov										×						×			
77	*Bulenides parvulus* sp. nov																×			
78	*Xylobanus blandus* sp. nov	×															×			
79	*Xylobanus benignus* sp. nov							×									×			
80	*Xylobanus lanatus* sp. nov			×																
81	*Xylobanus nitidus* sp. nov	×																		
82	*Xylobanus consimilis* sp. nov																×			
83	*Xylobanus consobrinus* sp. nov						×										×			
84	*Xylobanus pubens* sp. nov	×																		
85	*Xylobanus caelestis* sp. nov	×					×			×	×						×	×	×	
86	*Xylobanus barbarus* sp. nov	×					×													
87	*Xylobanus canaliculatus* sp. nov																×			
88	*Xylobanus brevis* sp. nov	×					×									×	×			
89	*Xylobanus bellus* sp. nov	×												×						
90	*Xylobanus quadratus* sp. nov	×																		
91	*Xylobanus basilensis* sp. nov																	×		

92	**Xylobanus paululus** sp. nov.	×														×	×			
93	*Xylobanus candidus* sp. nov.						×	×								×				
94	*Xylobanus pullatus* sp. nov.			×																
95	*Xylobanus consentaneus* sp. nov.	×						×									×			
96	*Xylobanus pudicus* sp. nov.	×						×												
97	*Xylobanus fragilis* sp. nov.						×										×	×		
98	*Xylobanus bicoloratus* sp. nov.	×															×			
99	*Xylobanus consociatus* sp. nov.	×		×													×			
100	*Xylobanus luzonicus* sp. nov.	×																		
101	*Metanoeus bakeri* sp. nov.	×								×			×			×	×	×		
102	*Metanoeus cognatus* sp. nov.							×							×	×	×			
103	*Protaphes confertulus* sp. nov.	×		×										×			×			
104	*Taphes acceptus* sp. nov.	×		×																
105	*Leptotrichalus cyaneiventris* Waterhouse	×	×				×								×		×			
106	*Leptotrichalus celsus* Kleine	×	×											×			×		×	
107	*Leptotrichalus accuratus* Kleine	×						×									×			
108	*Leptotrichalus femoralis* Kleine						×				×						×			
109	*Leptotrichalus dubitabilis* Kleine	×	×				×	×						×		×	×		×	
110	*Leptotrichalus cereus* Kleine	×															×			
111	*Leptotrichalus acidus* Kleine	×						×												
112	*Leptotrichalus acutus* Kleine	×																		
113	*Leptotrichalus acerbus* Kleine	×																		
114	*Leptotrichalus adolescens* Kleine	×																		
115	*Leptotrichalus dispar* sp. nov.			×																
116	*Leptotrichalus circumscriptus* Kleine																×			
117	*Leptotrichalus effeminatus* Kleine																×			
118	*Leptotrichalus cicatricosus* Kleine	×		×												×	×			
119	*Leptotrichalus adjunctus* Kleine	×						×												
120	*Leptotrichalus admirabilis* Kleine	×																		
121	*Trichalus clypeatus* sp. nov.						×										×			×
122	*Trichalus absonus* sp. nov.	×		×		×		×							×	×				
123	*Trichalus costilis* sp. nov.	×														×	×			
?124	*Trichalus nigricauda* Bourgeois																			
?125	*Trichalus longicollis* Bourgeois	×																		

Calochromus orbatus Waterhouse.

Calochromus orbatus WATERHOUSE, Cist. Ent. 2 (1877) 197.

LUZON, Provinz Rizal, Montalban (*G. Böttcher*). MINDANAO, Provinz Agusan, Butuan: Provinz Surigao, Surigao (*C. F. Baker*): Provinz Lanao, Momungan (*Böttcher*). MINDORO, Calapan (*Böttcher*). NEGROS, Cuernos Gebirge (*Baker*). PALAWAN, Iwahig (*C. M. Weber*).

Die Art ist weit verbreitet und schon von Waterhouse von Darjeeling bis zu den Philippinen nachgewiesen. Sie ist ohne Frage aus dem Westen eingewandert, wie das Vorkommen auf Palawan beweist. Nur für diese eine Art ist der angegebene Weg nachgewiesen worden. Die Variationsbreite ist nicht gross, die Philippinischen unterscheiden sich von den Indiern nicht.

Calochromus sororius sp. nov.

Habituell sieht die Art *orbatus* Waterhouse ähnlich, hat aber verwandtschaftlich nichts mit ihr zu tun. Sie gehört vielmehr zur Verwandtschaft von *conveniens*. Penisbau, Mandibulartaster, und Fühler sind wie bei jener Art. Auch der Prothorax stimmt damit überein. Ich sah aber niemals Uebergänge zu jener Art und kann daher nicht annehmen, dass es sich nur um eine Form derselben handelt. Von *orbatus* trennt der nicht quere Prothorax sicher und leicht.

Nach brieflicher Mitteilung Pic's ist *sororius* von seinem *palawanus* durch den weniger breiten und anders skulptierten Prothorax verschieden. Das Würde meine Ansicht, dass *sororius* nicht aus der *orbatus*-Verwandtschaft stammt, sondern zum *conveniens*-Kreis gehört, bestätigen.

Länge, 6.5 Millimeter; Breite (hum.), 1.75 bis 3.

MINDANAO, Provinz Lanao, Momungan: Provinz Surigao, Surigao (*Böttcher*). LUZON, Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*); 14 Männer, 9 Weiber. Holo- und Allotypus im Museum Natura Artis Magistra zu Amsterdam; Cotypen in meinem Besitz.

Calochromus macropalpis sp. nov.

Abdomen blaumetallisch, die Seiten mit Ausnahme der beiden letzten Segmente orangerot, Brust schwarz, überall orangerot behaart, Hinterbeine blaumetallisch, an den Vorder- und Mittelbeinen Schenkel und Schienen zum grössten Teil orangerot, Kopf dunkel, erstes bis sechstes Fühlerglied in mehr oder weniger grosser Ausdehnung orangerot, die folgenden blauschwarz.

Prothorax und Elytren orangerot, Schildchen blauschwarz. Mandibulartaster in beiden Geschlechtern enorm vergrössert (Tafel 1, Fig. 1). Erstes Glied orange, zweites zum Teil, drittes ganz schwarz. Drittes Fühlerglied etwas kürzer als das vierte, viertes bis siebentes etwa gleichlang, achtes bis zehntes kürzer aber unter sich gleichlang, fünftes bis achtes Glied auf der Unterseite mehr oder weniger concav eingebuchtet, die folgenden platter. Prothorax quadratisch oder etwas länger als breit, alle Ecken gerundet, Ränder stark aufgebogen, Mittelfurche tief, durchgehend. Elytren mit zwei deutlichen Rippen. Behaarung auf der Körperoberseite einzeln, lang.

Länge, 12 bis 14 Millimeter; Breite (hum.), 3, circa.

MINDANAO, Provinz Lanao, Momungan. LUZON, Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*); 2 Männer, 1 Weib. Holo- und Allotypus im Museum Natura Artis Magistra zu Amsterdam; Cotypus (Männchen) in meinem Besitz.

Es dürfte eine der interessantesten Arten sein, die ich in der Gattung gesehen habe. Wenn nicht alle andere Merkmale mit der Gattungsdiagnose übereinstimmten, könnte eine neue Gattung auf diese hypermorphen Mandibulartaster errichtet werden. Der Penis ist zwar von aparter Form, kommt aber in der Grundgestalt häufig in der Gattung vor.

Calochromus conveniens sp. nov.

Mann.—Unterseite des Körpers und die Beine blaumetallisch, Kopf und Fühler schwarzbraun, sonst ziegelrot bis lehmgelb. Elytren dicht, Prothorax schwächer behaart. Scheitel mit zarter Mittelfurche, Stirn flach vertieft, Punktierung und Behaarung einzeln, letztes Glied der Mandibulartaster platt, halbelliptisch, vorn flach abgerundet. Fühler dünn, bis zur Mitte der Elytren reichend, vom dritten ab alle Glieder doppelt so lang als breit, nur schwach gezähnt und kurz behaart. Prothorax viereckig, Ecken gerundet, Mittelfurche tief, keine Punktierung. Schildchen etwas vertieft. Auf den Elytren sind die Rippen wechselnd stark, zuweilen fehlend, Mittelcoxen nicht gedornt, Schienen gerade.

Weib.—Fühler kürzer, ferner durch das letzte Abdominalsegment verschieden.

Länge, 8 bis 17 Millimeter; Breite (hum.), 2 bis 4.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*); Mount Banahao (*Böttcher*): Provinz Rizal, Montalban (*Böttcher*); Provinz Nueva Vizcaya, Imugan, 4,000 Fuss; Bayombong, 1,000 Fuss (*Böttcher*): Provinz Camarines Sur, Mount Isarog, 4,000

Fuss: Provinz Bataan, Limay (*Böttcher*). SIBUYAN (*Böttcher*). PANAON (*Böttcher*). NEGROS (*Böttcher*); Cuernos Gebirge (*Baker*); Nakalang (*C. S. Banks*). MINDANAO, Provinz Surigao, Surigao (*Baker, Böttcher*): Provinz Lanao, Iligan (*Baker*); Kolambugan (*Baker, Böttcher*); Momungan (*Böttcher*): Provinz Zamboanga, Dapitan (*Baker*); Port Banga (*Böttcher*): Provinz Agusan, Butuan (*Baker*). SAN MIGUEL, Provinz Samar (*Böttcher*). Es lagen mir circa 100 Exemplare vor. Typen in meinem Besitz.

Die Variationsbreite ist sehr gross. Die roten Körperteile können von tiefem ziegelrot bis rötlichlehmgelb in allen Nuancen wechseln, die Körperfarbe bietet also keinen Anhalt die Art festzulegen. Das Schildchen wechselt in der Farbe sehr stark, es kann rot sein, meist ist es aber tiefschwarz. Sowohl im Material des Bureau of Science, wie in Böttcher's Material fand ich Individuen deren Elytren an der Basis blaumetallisch waren. Auf den ersten Blick könnte man an eine neue Art glauben, der Penisvergleich und der Umstand, dass gegen *conveniens* keine morphologischen Differenzen bestehen, lässt den varianten Charakter aber klar erkennen. Wenn man berücksichtigt, dass durch Dunkelfärbung des Schildchens eine bestimmte Tendenz zur Ausbreitung des blauen Farbenkomplexes vorhanden ist, so kann das Uebergreifen auf die Elytren nicht überraschen. Die varianten Tiere fanden sich mit normalgefärbten am gleichen Fundort. Ich sah sie von LUZON, Cagayan (*C. R. Jones*); Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*); und SAN MIGUEL, Samar (*Böttcher*). (Tafel 1, Fig. 6.)

Morphologische Differenzen sind mehrfach festzustellen gewesen. So ändert der Prothorax seine Form. Er kann länger werden als in Tafel 1, Fig. 4 dargestellt, die Vorderecken werden obsolet, alle Uebergänge sind vorhanden. Die Elytren sind zuweilen ohne deutliche Rippung oder es sind nur die primären Rippen an der Basis oder ganz entwickelt, andere lassen deutliche Primär- und Sekundärrippen erkennen. In jedem Falle bleibt die Rippenbildung absolut schwach.

Calochromus pallidulus sp. nov.

Abdomen, Brust, Beine, Kopf, und Fühler blauschwarz, glänzend, die basalen Glieder zuweilen etwas hell behaart, Oberseite schmutzig-orange. Mandibulartaster (Tafel 1, Fig. 9.) Fühler denen von *conveniens* sehr ähnlich. Prothorax gleich *conveniens*, aber ohne Mittelfurche. Elytren mit zwei schwachen, aber deutlich erkennbaren Rippen; Behaarung kurz, anliegend.

Länge, 10 bis 16 Millimeter; Breite (hum.), 2 bis 3.

MINDANAO, Provinz Lanao, Momungan (*Böttcher*), 3 Männer. Holo- und Allotypus im Museum Natura Artis Magistra zu Amsterdam; Cotypus (Weib) in meinem Besitz.

Es besteht einige Aehnlichkeit mit *conveniens*. Die Farbe ist aber nicht ziegelrot, sondern lehmgelb. Der Prothorax ist ohne Mittelfurche, platt. Das dritte Glied der Mandibulartaster ist länger als bei *conveniens*, die Taster sind überhaupt von anderer Gestalt. Auf jeden Fall trennt die Penisform, die bei *pallidulus macropalpis* ähnlich ist und nicht *conveniens*.

Bestimmungstabelle der philippinischen Calochromus-Arten.

1. Prothorax und Schildchen blaumetallisch; Elytren rotorange oder lehmgelb .... 2.
   Der ganze Oberkörper rotorange oder lehmgelb .... 3.
2. Prothorax quer, Vorderrand gerade .... **C. orbatus** Waterhouse.
   Prothorax halbelliptisch, Vorderrand gerundet .... **C. sororius** sp. nov.
3. Erstes bis viertes Fühlerglied gelb, die folgenden blauschwarz, vorletztes Glied der Mandibulartaster stark vergrössert, quadratisch. **C. macropalpis** sp. nov.
   Mandibulartaster klein .... 4.
4. Prothorax tief gefurcht; Mandibulartaster, Tafel 1, Fig. 3. **C. conveniens** sp. nov.
   Prothorax ohne Furche; Mandibulartaster, Tafel 1, Fig. 9. **C. pallidulus** sp. nov.

Genus **LYCOSTOMUS** Motschulsky

Lycostomus MOTSCHULSKY, Bull. Mosc. 1 (1861) 136.

Die Gattung ist weitverbreitet. Ob alles was heute zu *Lycostomus* gebracht wird wirklich dazu gehört ist fraglich und müsste erst durch monographische Arbeit geklärt werden. Die Art *similis* muss als ein Fremdling in der philippinischen Fauna angesehen werden. Die ganze Art der Ausfärbung spricht für westliche Herkunft, die übrigen sind sicher Endemismen.

Lycostomus similis Hope.

Lycostomus similis HOPE, Gray's Zool. Miscel. (1831) 26 (Mann).

Im ganzen orientalischen Gebiet. Das mir vorliegende Stück ist von Palawan, Iwahig (*J. R. White*). Auf den Philippinen selbst scheint die Art nicht vorzukommen und ist nach Erfahrungen bei anderen Coleopterenfamilien auch nicht anzunehmen.

Lycostomus frivolus sp. nov.

Unterseite des Körpers, Beine, Kopf, Fühler, und Schildchen blauschwarz, sonst lehmgelb, die dunklen Körperteile mehr oder weniger glänzend. Rüssel robust, länger als der Kopf, Stirn mit schmaler Mittelfurche, über den Fühlerbeulen grubig vertieft. Fühler schlank, drittes Glied das längste von allen, viertes bis zehntes etwa gleichlang, Zähnung sehr schwach. Prothorax, Tafel 1, Fig. 10, Punktierung sehr zart, einzeln; Schildchen zungenförmig, gerundet, glänzend. Elytren mit sehr zarten Rippen und flacher, unregelmässiger, punktartiger Skulptur.

Länge, 9 bis 19 Millimeter; Breite (hum.) 2.5 bis 4.5.

LUZON, Provinz Camarines Sur, Mount Isarog, 4,000 Fuss: Provinz Nueva Vizcaya, Bayombong, 1,000 Fuss (*Böttcher*): Provinz Laguna, Los Baños, Mount Maquiling (*Baker*). MINDANAO, Provinz Davao, Davao: Provinz Surigao, Surigao (*Baker*): Provinz Lanao, Momungan (*Böttcher*). SAMAR (*Baker*). SAN MIGUEL (Provinz Samar) (*Böttcher*). Es lagen mir 210 Männer und 126 Weiber vor. Typen in meinem Besitz.

Die Variation ist sehr gross, die Grösse schwankt um das Doppelte. Die Farbe wechselt insofern, als im südlichen Teil des Archipels, auf Süd-Luzon und Mindanao, die Oberseite des Körpers mehr rötlich ist, während nach Norden die Farbe hellerdbraun wird.

Die Männer sind von den Weibern durch andere Färbung des Abdomens unterschieden. In den südlichen Bezirken trifft noch deutliche Tendenz zur Blaufärbung hervor und die Seitenränder und letzten Abdominalsegmente sind meist noch ganz stahlblau. Nach Norden tritt die schwarze Farbe immer mehr zurück und verliert sich schliesslich ganz, so dass Ober- und Unterseite des Körpers gleich gefärbt sind. An der Aufhellung nimmt auch das Schildchen Anteil, Abstufungen finden sich von schwarz bis hellbraun. Die basalen Fühlerglieder sind in wechselnden Umfange aufgehellt und in ganz extremen Fällen werden auch die Schenkel und Schienen braun.

Bei den weiblichen Tieren ist die Tendenz zur Aufhellung geringer. In den südlichen Bezirken ist keine Verkleinerung der schwarzen Farbenkomplexe nachweisbar, im Norden machen sich die braunen Farbentöne stärker bemerkbar.

Im Uebrigen waren keine Variationen festzustellen. Es sind überall Stichproben durch Penisuntersuchungen gemacht worden, das Ergebnis war immer positiv.

Von der folgenden Art (*flavotestaceus*) durch die schwache Rippenbilding, das lange vierte und fünfte Fühlerglied und den ganz anders geformten Penis leicht zu trennen.

Lycostomus flavotestaceus sp. nov.

Schwarz mit schwachem, blauem Anflug, Prothorax und Elytren lehmgelb, die dunklen Körperteile glänzend, die hellen matt. Drittes Fühlerglied des Mannes wenigstens doppelt so lang wie breit, viertes bis zehntes kaum länger als breit, kräftig gezähnt. Fühler des Weibes von gleicher Gestalt. Prothorax trapezoid, breiter als lang, Vorderrand gerundet, und ohne Ecken in den Seitenrand übergehend. Hinterrand flach nach innen geschwungen, Hinterecken rechteckig, nicht vorgezogen, Seiten aufgebogen. Elytren normal. Penis, Tafel 1, Fig. 14.

Länge, 15 bis 22 Millimeter; Breite (hum.), 4 bis 6, lat. max. 11.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*): Provinz Laguna, Los Baños (*Baker*); Mount Maquiling (*Baker*). MINDANAO, Provinz Agusan, Butuan; Cabadbaran (*Weber*): Provinz Lanao, Iligan; Kolambugan (*Baker, Banks*); Momungan (*Böttcher*): Provinz Davao, Davao (*Weber*): Provinz Surigao, Surigao (*Baker*): Provinz Zamboanga, Dapitan (*Baker*). SIARGAO, Cabuntog (*Böttcher*). TICAO (*R. C. McGregor*); 27 Männer, 16 Weiber. Typen in meinem Besitz.

Die Variationsbreite war sehr gering, Farbenabweichungen von hell lehmgelb bis rotorange kommen vor. Die Artdifferenzen gegen *frivolus* sind dort angegeben.

Lycostomus pygmaeus sp. nov.

Unterseite des Körpers, Fühler, Kopf, und Beine blauschwarz, Prothorax rotorange mit einem schwarzen Längsstreifen in der Mitte, der von einem Rand zum anderen reicht; Schildchen schwarz; Elytren rotorange. Drittes Fühlerglied doppelt so lang wie das vierte, viertes bis elftes etwa gleichlang, nach vorn schmäler aber nur wenig kürzer werdend, basale Glieder stumpf, die übrigen stumpf gezähnt. Prothorax, Tafel 1, Fig. 15. Punktierung obsolet. Erste und zweite Rippe auf den Elytren deutlich, dritte unscharf, vierte kräftig, am Humerus sehr stark hervortretend. Penis, Tafel 1, Fig. 16 und 17.

Länge, 8 bis 12 Millimeter; Breite (hum.), 2.5 bis 3.

LUZON, Provinz Camarines Sur, Mount Isarog, 4,000 Fuss. MINDANAO, Provinz Lanao, Momungan (*Böttcher*); 19 Männer, 14 Weiber.

Die Ausfärbung der Körperoberseite wechselt in üblicher Weise von orangerot bis lehmgelb. Der schwarze Streifen des

Prothorax wechselt in der Breite, bleibt aber immer schmal. Die Fühler ähneln denen von *flavolateralis* sehr, beim Weib sind sie gedrungener als beim Mann, sonst von gleicher Gestalt. Die Gestalt des Prothorax ist sehr konstant. Mit keiner anderen Art zu verwechseln.

Bestimmungstabelle der philippinischen Lycostomus-Arten.

1. Prothorax mit mittlerem schwarzem Längsstreifen.............................. 2.
   Ohne Längsstreifen.. 3.
2. Grosse Art, Prothorax und Elytren zinnoberrot (nur von Palawan).
   L. similis Hope.
   Kleine Art, Elytren lehmgelb (von den Philippinen).
   L. pygmaeus sp. nov.
3. Drittes Fühlerglied wenig länger als das vierte und die folgenden, Mann mit braunem Abdomen; mittelgrosse Art........ **L. frivolus** sp. nov.
   Drittes Fühlerglied etwa doppelt so lang wie das vierte, viertes und fünftes gleichlang; grosse Art; Abdomen des Mannes immer blauschwarz.. **L. flavotestaceus** sp. nov.

Genus PLATEROS Bourgeois

Plateros BOURGEOIS, Compt. Rend. Soc. Belg. 12 (1879) XIX.

Der Gattungshabitus ist durchaus einheitlich. Es sind alles kleine, selten 7 bis 8 Millimeter erreichende Arten. Die verwandtschaftliche Nähe von *Ditoneces* ist recht gross und weibliche Tiere sind meist nicht festzulegen, weil nicht einmal sicher zu sagen ist ob das Tier zu dieser oder jener Gattung zu stellen ist. Ich habe keinen weiteren Unterschied als die pectinaten Fühler des Mannes bei *Ditoneces* feststellen können; bei *Plateros* sind die Fühler immer einfach. Während es bei manchen Lycidengattungen möglich ist, durch vergleichende Untersuchung des männlichen Begattungsorganes die Gattungszugehörigkeit festzulegen, ist das sowohl bei *Plateros* wie bei *Ditoneces* nicht möglich, da in beiden Gattungen der Penis von grosser Vielgestaltigkeit ist. Artfestlegung ohne Mann ist daher zu unterlassen, selbst sichere Determinationen sind oft nicht möglich, wenn keine Penisautopsie vorgenommen werden kann.

Plateros scheint auf den Philippinen an der Ostgrenze zu sein. Von den Molukken, von Neu Guinea, und Australien sah ich noch keine Belegstücke, wie überhaupt der ganze Verwandtschaftskreis nicht über das orientalische Gebiet östlich hinausgegangen zu sein scheint. Auf den Philippinen hat sich ein ansehnlicher Artbestand ergeben, namentlich hat Professor Baker grosses Material beigebracht. Zweifellos ist der Artbestand noch viel grösser; weitere Forschungen werden das beweisen.

Plateros ordinarius sp. nov.

Abdomen dunkelbraun, Brust gelb, Schenkel aller Beine in der basalen Hälfte und die Hüften gelb, sonst dunkelbraun mit teilweise heller Behaarung, Kopf gelb, Fühler schwarz, nur das erste Glied an der Basis gelb; Oberseite ganz gelb; Glanz mässig. Fühler kräftig, gezähnt, drittes Glied dreieckig, die folgenden länger als breit, nach vorn an Breite abnehmend, nicht aber an Länge, Skulptur grob, Behaarung einzeln. Prothorax, Tafel 1, Fig. 18. Schildchen nur flach eingebuchtet, lang behaart. Auf den Elytren sind Rippen und Gitterung durch dichte Behaarung verdeckt. Penis, Tafel 1, Fig. 19.

Länge, 9 bis 12 Millimeter; Breite (hum.), 3 bis 3.5.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*). MINDANAO, Provinz Davao, Davao (*Baker*): Provinz Surigao, Surigao (*Baker, Böttcher*): Provinz Lanao, Kolambugan (*Böttcher*): Provinz Agusan, Butuan (*Böttcher*). LEYTE, Santa Cruz (*Böttcher*); 18 Männer und Weiber. Holo- und Allotypus in meinem Besitz.

Von allen *Plateros*-Arten mit einfarbiger Körperoberseite ist *ordinarius* durch den langen Prothorax ausgezeichnet und leicht kenntlich. Es ist die grösste Art die ich von den Philippinen kennen gelernt habe und eine der grössten Arten überhaupt.

Plateros contortus sp. nov.

Dem *Plateros expletus* Waterhouse von Borneo sehr nahe stehend, in der Ausfärbung völlig gleich. Die Körperoberseite ist aber nur ganz schwach behaart, auf den Elytren werden Rippen und Furchen nicht verdeckt, sondern treten scharf hervor. Stirn an der schmalsten Stelle schmäler als ein Augendurchmesser, flach grubig vertieft, die Grube zu einer flachen Furche auslaufend, Behaarung schwach. Fühlerglieder des Mannes scharf gezähnt, einzeln, lang behaart, des Weibes gedrungener aber auch gezähnt, kürzer behaart. Prothorax quadratisch, Seiten gerade, Hinterrand kaum etwas geschwungen, Hinterecken obsolet, am Vorderrand kein Kiel, Punktierung in den Randpartieen schwach.

Länge, 4 bis 7 Millimeter; Breite (hum.), 1.25 bis 2.

LUZON, Mount Banahao: Provinz Laguna, Mount Maquiling (*Baker*). MINDANAO, Provinz Lanao, Iligan: Provinz Surigao, Surigao (*Baker*). BASILAN (*Baker*). NEGROS, Cuernos Gebirge (*Baker*); 5 Männer, 2 Weiber. Typen in meinem Besitz.

Soweit sich an dem kleinen Material erkennen lässt, handelt es sich um eine stark variierende Art, die von *expletus* am sichersten durch den Penis zu trennen ist. Die oben angeführten Merkmale sind aber auch zu beachten.

Plateros senex sp. nov.

Unterseite des Körpers mit Ausnahme der Schenkelbasis und die Fühler hellockerfarbig, sonst hellgelb in wechselnder Tiefe. Stirn steil abfallend, über den Fühlerbeulen flach, gross eingedrückt, ohne nennenswerte Skulptur, Augen sehr gross, prominent, schwarz. Prothorax quadratisch, Vorderrand rund abfallend, Vorderecken stumpf, Seiten gerade, Hinterrand flach nach innen gebogen, Hinterecken obsolet, rechtwinklig, basale Mittelfurche kurz und breit, Randpunktierung stark, Behaarung nur am Rande deutlich. Auf den Elytren sind Rippen und Gitterung sehr flach und durch die kurze, dichte Behaarung verdeckt.

Länge, 5 bis 7 Millimeter; Breite (hum.), 1.5 bis 2.

LUZON, Provinz Laguna, Los Baños (*Baker*); Mount Maquiling (*Baker*). MINDANAO, Provinz Davao, Davao (*Baker*): Provinz Zamboanga, Port Banga (*Böttcher*). SAMAR (*Böttcher*); 2 Männer, 4 Weiber. Typen in meinem Besitz.

Variation sehr gering und auf dem Prothorax beschränkt. Mit *contortus* in Habitus und Ausfärbung übereinstimmend. Durch den Penis leicht zu trennen. Aeusserlich durch die ganz obsolete Gitterung und dichte Behaarung der Elytren trennbar.

Plateros pilosus sp. nov.

Abdomen, Metasternum zum Teil, Beine mit Ausnahme der Schenkelbasis und Fühler braun, sonst hellgelb, am Kopf die Mandibulartaster verdunkelt. Drittes bis elftes Fühlerglied gleichlang, die basalen mehr dreieckig, nach vorn an Breite abnehmend, dicht behaart. Prothorax breiter als lang, Vorderrand flach gerundet, Vorderecken rund aber deutlich, Seiten flach nach innen geschwungen, Hinterecken kaum vorgezogen, Hinterrand flach nach innen gebuchtet, mittlerer Basaleindruck klein und flach, Ränder mässig aufgebogen, Punktierung einzeln, grob. Elytren mit kurzer, dichter Behaarung, Gitterung schwach erkennbar.

Länge, 6 bis 6.5 Millimeter; Breite (hum.), 2 mm circa.

LUZON, Provinz Laguna, Mount Banahao, 2,000 Fuss (*Böttcher*). MINDANAO, Provinz Lanao, Momungan (*Böttcher*); 1 Mann und 1 Weib. Holo- und Allotypus im Museum Natura Artis Magistra zu Amsterdam.

Dem *Plateros senex* am nächsten stehend und ohne Penisvergleich kaum zu unterscheiden. Der Prothorax ist quer, was bei *senex* nicht der Fall ist, dort ist die Gestalt mehr quadratisch, der Vorderrand ist rundlich, die Vorderecken sind flach.

Plateros luteolus sp. nov.

Mann.—Schwarzbraun, Prothorax, Schildchen, und Elytren rotgelb. Stirn so breit wie ein Augendurchmesser, über den Fühlerbeulen flach vertieft, Fühlerbeulen gross, flach, Behaarung einzeln. Prothorax länger als breit, Vorderrand gerundet, Vorderecken obsolet, Seiten vor dem Hinterrand schwach nach innen gebuchtet, Hinterecken spitz, seitlich vorgezogen, Hinterrand flach geschwungen, Mittelgrube am Hinterrand tief, auf dem Diskus mit einzelnen flachen Vertiefungen, Ränder aufgebogen, Punktierung gross, einzeln, Behaarung sehr kurz. Drittes Fühlerglied kürzer als das vierte, viertes bis elftes gleichlang, das dritte dreieckig, die folgenden an Breite abnehmend. Elytren mit deutlicher Gitterung, Behaarung einzeln, kurz.

Länge, 5 bis 5.5 Millimeter; Breite (hum.), 1.5.

MINDANAO, Provinz Lanao, Momungan (*Böttcher*), 4 Männer. Holotypus im Museum Natura Artis Magistra zu Amsterdam; Cotypus in meinem Besitz.

Aus der Verwandtschaft von *expletus* Waterhouse und *contortus* sp. nov.; durch die Gestalt des Prothorax und den ganz anders gebauten Penis leicht und sicher zu unterscheiden.

Plateros generalis sp. nov.

Mann.—Dem *Plateros contortus* sehr ähnlich, Unterseite des Körpers, Beine, und Fühler aber schwarz, auch der Prothorax und die Elytren sind etwas dunkler. Die Fühler haben eine andere Form als *contortus*, die Fühlerglieder sind nicht gezähnt, sondern nach beiden Seiten gleich vorstehend, die Behaarung ist dicht und kurz, nicht einzeln und lang wie bei *contortus*. Der Prothorax ist an den Hinterecken stark vorgezogen, im Gegenteil zu *contortus* wo sie rechteckig sind. Penis spatelförmig, fast hyalin.

Länge, 6 Millimeter; Breite (hum.), 2.

MINDANAO (*Dr. A. Moore*). Holotypus im Britischen Museum.

Plateros lepidus sp. nov.

Abdomen und Beine mit Ausnahme der basalen Schenkelhälfte schwarzbraun, letztere gelb, Brust und Kopf desgleichen, Mandibularpalpen verdunkelt. Erstes Fühlerglied gelb, die folgenden schwarzbraun, Prothorax, Schildchen, und Elytren gelb. Stirn schmäler als ein Augendurchmesser, vertieft, Fühlerbeulen schwach, durch eine flache Mittelfurche getrennt, einzeln punktiert und behaart. Drittes bis viertes Fühlerglied gleichlang, die basalen keilförmig, mit kurzem Zahn, nach vorn werden die Glieder schmäler und sind ungezähnt. Prothorax fast quadratisch, Vorderrand rund, Vorderecken stumpf aber deutlich, Seiten fast gerade, Hinterrand nach innen gebuchtet, Hinterecken vorgezogen, Punktierung an den Rändern kräftig, Basaleindruck kurz und schmal, Skulptur gering, Behaarung schwach. Schildchen rechteckig, nicht ausgebuchtet, dicht behaart. Elytren mit deutlicher Rippen- und Gitterbildung, die durch die Behaarung nicht verdeckt wird.

Länge, 6 Millimeter; Breite (hum.), 2.

MINDANAO, Provinz Lanao, Kolambugan (*Banks*): Provinz Agusan, Cabadbaran (*Weber*). SAMAR (*Baker*). Holotypus in meinem Besitz.

Durch die Penisform sicher von allen Arten zu trennen.

Plateros fucosus sp. nov.

Abdomen und Metasternum braunschwarz, Brust gelbbraun, Beine dunkelbraun, Hüften heller, das vordere Beinpaar ganz allgemein heller, Kopf und Fühler dunkelbraun, Mandibeln heller, Prothorax, Schildchen, und Elytren rotgelb, auf letzteren ein keilförmiger, schwarzer Streifen, der an der Sutura schmal, gegen den Hinterrand breiter wird. Fühler, Tafel 1, Fig. 30; Prothorax, Fig. 31. Mittelfurche von der Basis bis zur Mitte reichend, die an den Seitenrändern liegende Punktierung einzeln und tief, Behaarung schwach. Auf den Elytren sind Rippen und Gitterung sehr deutlich, wenn auch nur flach, Behaarung schwach.

Länge, 6 bis 7 Millimeter; Breite (hum.), 2, circa.

LUZON, Provinz Laguna, Los Baños (*Böttcher*). SAMAR (*Baker*). PANAON (*Böttcher*). LEYTE, Burauen (*Böttcher*); 2 Männer, 3 Weiber; Typen in meinem Besitz.

Die Variation, auch in der Ausfärbung, ist nur sehr gering. In der Gattung ist mir keine Art mit ähnlicher Farbenverteilung bekannt, die eigenartige Form des Penis trennt die Art sicher von allen anderen.

Plateros cuneatus sp. nov.

Schwarzbraun, nur die Elytren in der basalen Hälfte bleichgelb. Stirn so breit wie ein Augendurchmesser, flach, gross vertieft. Fühler des Mannes sehr schlank, abstehend, lang behaart, des Weibes kürzer, dichter und kürzer behaart. Prothorax mit flachem Vorderrand, seitlich rund umgebogen, Seiten gerade, Hinterrand nur ganz flach geschwungen, Hinterecken stark nach aussen spitz vorgezogen, alle Ränder, namentlich die äusseren, schmal, scharfkantig, stark erhöht, Vertiefung am Hinterrand kurz grubig, Punktierung nur aus einer an allen Rändern liegenden Punktreihe bestehend, Behaarung fehlt fast gänzlich. Elytren mit breiten, flachen Rippen, Gitterung deutlich, Behaarung kurz.

Länge, 6 bis 9.5 Millimeter; Breite (hum.), 1.5 bis 2.

LUZON, Subprovinz Benguet, Baguio (*Baker*). MINDANAO, Provinz Zamboanga, Dapitan (*Baker*) ; 13 Männer und Weiber. Typen in meinem Besitz.

Es handelt sich um eine grosse Art, wohl den grössten *Plateros* den ich aus dem orientalischen Gebiet gesehen habe. Die Art variiert insofern als der Prothorax an den Seiten gelbe Ränder haben kann. Der Penis ist von allen Arten weit verschieden, ich habe aber sonst keinen Grund, die Art aus der Gattung herauszunehmen.

Plateros ponderosus sp. nov.

Mann.—In der Ausfärbung dem *cuneatus* ähnlich. Stirn mit tiefer, elliptischer Grube, deren Ränder grob gerunzelt sind; Augen sehr gross, prominent, im Durchmesser bedeutend breiter als die Stirn. Prothorax breiter als hoch, Vorderrand dachförmig abfallend, Vorderecken stumpf, Seiten gerade, nach dem Hinterrand erweitert, Hinterrand leicht nach innen geschwungen, Hinterecken vorgezogen, Seitenränder stark aufgebogen, Punktierung nur am Vorderrand gross und deutlich, Behaarung dichter als bei den vorigen Arten. Schildchen und Elytren gleich *cuneatus*.

Länge, 8.5 Millimeter; Breite (hum.), 2, circa.

LUZON, Subprovinz Benguet, Pauai (Haight's Place) (*Böttcher*), 3 Männer. Holotypus in meinem Besitz.

Von *luzonicus* und *popularis* durch die grossen Augen, die tief grubige Stirn und die kräftig gezähnten Fühler verschieden. Ohne Penisautopsie von diesen Arten wie von *cuneatus* nicht zu trennen.

Plateros luzonicus sp. nov.

In der Ausfärbung mit *cuneatus* übereinstimmend. Stirn so breit wie ein Augendurchmesser, flach vertieft, Punktierung und Behaarung sehr zerstreut. Fühlerglieder vom dritten an flach gezähnt, nach den vorderen Gliedern nimmt die Zähnung ab; drittes Glied etwa doppelt so lang wie in der Mitte breit, die folgenden länger, nach der Spitze zu an Länge gleich bleibend, an Breite abnehmend, grob skulptiert und abstehend behaart. Prothorax breiter als lang, Vorderrand gerundet, Vorderecken stumpf, Seiten flach nach innen gebogen, Hinterrand gerade, Hinterecken nicht vorgezogen, Punktierung nur an den Rändern kräftig; Behaarung schwach, nur die Ränder sind stärker behaart. Schildchen hinten gerade. Elytren gleich *cuneatus*.

Länge, 6 bis 6.5 Millimeter; Breite (hum.), 2, circa.

LUZON, Subprovinz Benguet, Pauai (Haight's Place) (*Böttcher*): Subprovinz Bontoc, Mount Polis, 2,400 Fuss (*Böttcher*); 4 Männer, 3 Weiber. Typen in meinem Besitz.

Ohne nähere Prüfung könnte man glauben *cuneatus* vor sich zu haben. Der Prothorax ist aber gedrungener, quer, und hat keine vorgezogenen Hinterecken. Die Fühler sind auch von anderer Gestalt. Auf alle Fälle trennt der Penis sicher.

Plateros popularis sp. nov.

Mann.—Dem *luzonicus* habituell ganz gleich, nur kleiner. Die dunkle Partie auf den Elytren reicht aber nicht nur bis zur Mitte und ist dann nach hinten umgebogen, sondern lässt höchstens das vordere Drittel frei und ist nach aufwärts gebogen. Der gänzlich anders gebaute Penis, Tafel 1, Fig. 38.

Länge, 5 Millimeter; Breite (hum.), 1.75, circa.

LUZON, Subprovinz Benguet, Baguio (*Baker*); Trinidad (*Böttcher*): Subprovinz Amburayan, Naeba (*Böttcher*). Holotypus in meinem Besitz, Allotypus im Dresdener Museum.

Plateros fulgidus sp. nov.

Mann.—Schwarzbraun, Vorder- und Mittelbeine bis zur Mitte der Schenkel, an den Hinterbeinen die Hüften gelbbraun, Kopf, Fühler, und Elytren schwarzbraun, Prothorax an den Rändern gelbbraun. Stirn glatt, fast senkrecht, an den Fühlerbeulen nur wenig eingedrückt, zart punktiert und behaart. Fühler robust, vom dritten Gliede ab länger als breit, nach der Spitze zu nehmen die Glieder an Breite, nicht an Länge ab, Behaarung robust. Prothorax fast quadratisch, Vorderrand gerundet, Vorderecken stumpf, Seiten gerade. Hinterrand flach nach innen geschwungen, Hinterecken rechteckig, an den Rändern mit einer tiefen, groben Punktreihe, sonst ohne Skulptur. Schildchen gerundet. Auf den Elytren sind Rippen und Gitterung flach aber deutlich, dicht behaart.

Länge, 4 Millimeter; Breite (hum.), 1.2, circa.

LUZON, Provinz Bataan, Lamao (*Böttcher*). MINDORO, Calapan (*Böttcher*). SAMAR (*Baker*). Weib nicht gesehen.

Die grösste Aehnlichkeit besteht mit *conspiciendus*. Der Penis ist aber von ganz anderer Gestalt, die Elytren sind an der Basis nicht hellgelb, ebenso ist der Prothorax nicht ganz gelb sondern auf dem Diskus zum grössten Teil schwarzbraun, die Brust ist nicht hellgelb, sondern gleichfalls schwarzbraun,

Plateros tenebrans sp. nov.

Rauchbraun, Mandibeln, Prothorax an den Rändern, und Humerus der Elytren heller. Stirn über den Fühlerbeulen mehr oder weniger kreisförmig vertieft, an den Beulen ist die grösste Tiefe, Scheitel und Stirn stark glänzend, einzeln, lang behaart. Fühler sehr schlank, drittes bis zehntes Glied etwa gleichlang, das einzelne Glied circa 2.5 mal so lang wie breit, drittes bis zehntes schwach gezähnt, einzeln, abstehend, lang behaart. Prothorax breiter als lang, Vorderrand schräg abfallend, Vorderecken deutlich, stumpfkantig, Seiten schräg nach hinten erweitert, gerade, Hinterrand kräftig nach innen geschwungen, Hinterecken etwas vorgezogen, basale Mittelfurche sehr kurz, breit, Punktierung an allen Rändern kräftig und gross, Behaarung einzeln. Rippen und Gitterung sehr deutlich, Gitterung so breit wie die Rippen, Behaarung kurz, mässig dicht.

Länge, 5 Millimeter; Breite (hum.), 1.5 mm circa.

LUZON, Provinz Laguna, Mount Banahao, 2,000 Fuss (*Böttcher*). MINDANAO, Provinz Lanao, Iligan (*Baker*); Kolambugan (*Baker, Böttcher*). MINDORO, San Teodoro (*Böttcher*); 4 Männer, 4 Weiber. Typen in meinem Besitz.

Der Prothorax hat nur sekundären systematischen Wert, die Seitenränder können statt nach aussen, nach innen gerichtet sein, so dass eine ganz andere Gestalt zu Stande kommt. Nach dem Penisvergleich liegt aber tatsächlich nur eine Art vor.

Plateros contrarius sp. nov.

In der Ausfärbung gleich *contextus*. Stirn breiter als ein Augendurchmesser, flach grubig eingedrückt, schwach behaart. Fühler gedrungen, kräftig gezähnt, dicht, kurz behaart. Prothorax breiter als lang, am Vorderrand mit kurzem, breitem Kiel, Diskus abgeplattet, am Hinterrand nur wenig vertieft, Seiten und Hinterrand flach geschwungen, nur an den Rändern mit einfacher, kräftiger Punktreihe, Vorder- und Seitenränder gelblich. Elytren wie der Prothorax schwach behaart, Rippen und Gitterung daher deutlich.

Länge, 5 Millimeter; Breite (hum.), 1.25, circa.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*): Provinz Bataan, Lamao (*H. Cuzner*). MINDORO, San Teodoro (*Böttcher*); 3 Männer, 4 Weiber. Typen in meinem Besitz.

Von den ähnlichen Arten *contextus, constans,* und *borneensis* durch die robusten Fühler leicht zu trennen; der Penis beseitigt jeden Zweifel über die Artzugehörigkeit.

Plateros simillimus sp. nov.

Mann.—Von *contrarius* nur durch die Gestalt des Prothorax und des Penis unterschieden. Prothorax breiter als lang, dachförmig, Vorderecken deutlich winklig, Seiten nach innen verengt, die engste Stelle hinter der Mitte, Hinterecken spitz, vorgezogen, Hinterrand nach innen gebuchtet, Seitenränder stark erhöht, am Hinterrand in der Mitte grubig vertieft, gegen den Vorderrand flacher und breiter werdend, Ränder mit grober Punktierung, Behaarung kurz, mässig.

Länge, 4.5 Millimeter; Breite (hum.), 1.2, circa.

LUZON, Provinz Laguna, Mount Banahao, 2,000 Fuss (*Böttcher*). Typus im Museum Natura Artis Magistra zu Amsterdam.

Plateros triangulus sp. nov.

Mann.—Gleichfalls mit *contrarius* habituell übereinstimmend und wie *simillimus* durch Prothorax und Penis unterschieden. Prothorax so lang wie an den Hinterecken breit, Vorderrand steil abfallend, Vorderecken obsolet, Seiten nicht eingebuchtet, sondern nach hinten erweitert, Hinterrand flach geschwungen, Hinterecken spitz vorgezogen, Ränder, namentlich seitlich, aufgebogen, Grube am Hinterrand flach, Punktierung und Behaarung wie bei *simillimus.*

Länge, 5.5 Millimeter; Breite (hum.), 1.5.

LUZON, Provinz Laguna, Mount Banahao, 2,000 Fuss (*Böttcher*). Typus im Museum Natura Artis Magistra zu Amsterdam.

Plateros contextus sp. nov.

Erdgrau, nur der Prothorax in wechselnder Tiefe gelb, Stirn 1.5 mal so breit wie ein Augendurchmesser, flach eingesenkt, zart behaart. Fühlerglieder des Mannes stärker, des Weibes kaum gezähnt, beim Mann kräftig und lang behaart, beim Weib nur kurz. Alles übrige gleich *constans.* Penis seitlich breitgedrückt, fast unpigmentirt.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*). MINDANAO, Provinz Surigao, Surigao (*Baker*) ; 1 Mann, 1 Weib. Typen in meinem Besitz.

Von *constans* in manchen Stücken nur durch den gänzlich anderen Penis trennbar.

Plateros conspiciendus sp. nov.

Schwarz, Prosternum, die Schenkel in mehr oder weniger grossem Umfange, Kopf, Prothorax und Schildchen schmutzig-orange. Stirn breiter als ein Augendurchmesser, flachgrubig vertieft. Fühler gedrungen, alle Glieder kurz, breit stark gezähnt. Prothorax des Mannes breiter als lang, vorn gerundet, unmerklich in die Seiten übergehend, Hinterrand flach geschwungen, Hinterecken nur schwach, Prothorax des Weibes mehr quadratisch, Punktierung namentlich am Vorderrand dicht. Behaarung auf den Elytren die Skulptur nicht verdeckend.

Länge, 6 Millimeter; Breite (hum.), 1.5, circa.

LUZON, Provinz Zambales (*Baker*). SIBUYAN (*Baker*) ; 1 Mann, 4 Weiber. Typen in meinem Besitz.

Die Elytren sind von tiefschwarzbrauner Farbe und heben sich von dem hellen Prothorax und Schildchen stark ab, bei *testaceus* sind die Farbendifferenzen geringer und können bei unreifen Stücken undeutlich werden.

Plateros testaceus sp. nov.

Mann.—Abdomen, Brust zum Teil, Beine mit Ausnahme der basalen Schenkelhälfte und Hüften, Fühler, Kopf, und Elytren bis dicht an den Prothorax irdenfarbig, sonst gelb; Glanz mittelstark. Stirn schmal, nur so breit wie ein Augenhalbmesser, flach gefurcht, einzeln behaart. Fühler kurz, drittes Glied dreieckig, etwas länger als das vierte, viertes bis elftes gleichlang, nach vorn an Breite abnehmend, abstehend behaart. Prothorax quadratisch, Vorderrand gerundet, Vorderecken stumpf, Seiten flach nach innen gebogen, Hinterrand desgleichen, Hinterecken spitz aber nur wenig vorgezogen, Vorderrand kräftig, Seiten und Hinterrand schwächer punktiert; Behaarung sehr zart und schwach. Schildchen und Elytren ohne besondere Merkmale. Penis, Tafel 2, Fig. 6.

Länge, 4.5 Millimeter; Breite (hum.), 1.5.

LUZON, Provinz Laguna, Los Baños (*Baker*) ; Mount Maquiling (*Baker*). MINDANAO, Provinz Agusan, Butuan (*Baker*). Holotypus in meinem Besitz.

Plateros conspicuus sp. nov.

Dem *Plateros conspiciendus* sehr ähnlich und nur durch die an der Basis gelben Elytren verschieden. Während bei jener Art nur Prothorax und Schildchen gelb sind, greift hier die gelbe Farbenpartie immer auf die Elytren über. Dass es sich um eine sichere, eigene Art handelt, ergibt die Untersuchung des Penis, der von ganz anderer Gestalt ist.

Länge, 3.5 bis 6.5 Millimeter; Breite (hum.), 1 bis 1.5.

NEGROS, Cuernos Gebirge (*Baker*), 3 Männer, 4 Weiber. Typen in meinem Besitz.

Die Variationsgrenzen sind sehr gering, doch ist Trennung von nahestehenden Arten nur durch den Begattungsapparat möglich.

Plateros bakeri sp. nov.

Mann.—Abdomen und Metasternum schwarz, Vorderbrust gelb, Beine schwarz, nur die Schenkelbasis und die Hüften gelbrot, behaart, Kopf und Fühler schwarz, Prothorax schwarz, Ränder gelbbraun, Schildchen schwarz, Elytren im basalen Fünftel gelbbraun, sonst schwarz. Stirn so breit wie ein Augendurchmesser, über den Fühlerbeulen ein grosser, flacher Eindruck, der sich dicht an den Beulen zum kleinen Punkt vertieft, Beulen mässig stark. Mittelfurche flach, Punktierung und Behaarung schwach. Drittes und viertes Fühlerglied keilförmig, fünftes bis elftes gleichlang, nach vorn schmäler werdend, fünftes bis achtes schwach gezähnt, neuntes bis elftes ohne Zähne, Behaarung hell, dicht, abstehend. Prothorax quadratisch, Vorderrand rund, Vorderecken stumpf, Hinterrand flach nach innen gebuchtet, Hinterecken schräg nach aussen vorgezogen, an den Rändern stark und schmal vertieft, Punktierung nur am Vorderrand deutlich, Behaarung schwach, der grubige Basaleindruck breit, tief. Schildchen flach eingebuchtet, dicht behaart. Rippen und Gitterung auf den Elytren deutlich, durch die zarte Behaarung nicht verdeckt.

Länge, 5 Millimeter; Breite (hum.), 1.8.

SAMAR (*Baker*), 2 Männer. Holotypus in meinem Besitz.

Plateros constans sp. nov.

Habituell gleich *borneensis*, auch in der Ausfärbung gleich, durch die Form des Prothorax und den gänzlich anderen Penis verschieden. Prothorax breiter als lang, Vorderrand dachförmig abfallend, seitlich stumpfkantig, Seiten gerade, Hinterecken spitz aber nur kurz, am Vorderrand mit kurzem, scharfem Mittelkiel, am Hinterrand tief eingedrückt, Punktierung am Vorderrand tief, grob, am Seiten- und Hinterrand weniger scharf, aber doch sicher vorhanden.

Länge, 4 bis 5 Millimeter; Breite (hum.), 1 bis 1.25, circa.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*). MINDANAO, Provinz Lanao, Iligan; Kolambugan: Provinz Surigao, Surigao: Provinz Agusan, Butuan (*Baker*). BASILAN (*Baker*). NEGROS, Cuernos Gebirge (*Baker*); 8 Männer, 6 Weiber. Typen in meinem Besitz.

Variiert nur durch Erweiterung der hellen Partieen auf dem Prothorax, im allgemeinen scheinen die Differenzen aber gering zu sein.

Plateros continens sp. nov.

Ausfärbung gleich *constans*. Stirn breiter als ein Augendurchmesser, tief längsgefurcht, einzeln behaart. Fühler normal. Prothorax gleich *constans*. Elytren dicht, anliegend behaart. Penis, Tafel 2, Fig. 11.

Fühlerglieder des Weibes gedrungener als beim Mann.

Länge, 6 Millimeter; Breite (hum), 1.5, circa.

MINDANAO, Provinz Surigao, Surigao (*Baker*). SAMAR (*Baker*); 1 Mann, 2 Weiber. Typen in meinem Besitz.

Von *constans* nur bei Penisautopsie trennbar.

Plateros fraudulentus sp. nov.

Habitus und Ausfärbung gleich *continens*. Fühlerglieder kürzer, höchstens 1.5 mal so lang wie breit, ganz dicht und zart behaart. Prothorax mehr quadratisch, seitlich parallel, Hinterecken spitz nach hinten vorgezogen, Punktierung an den Rändern grob, Behaarung lang, mittelstark. Schildchen quer, hinten gerade. Elytren in Skulptur gleich *continens*.

Länge, 4.5 bis 5.5 Millimeter; Breite (hum.), 1.5 circa.

LUZON, Provinz Laguna, Los Baños; Mount Maquiling; Mount Banahao (*Baker*). MINDANAO, Provinz Lanao, Iligan (*Baker*); Momungan: Provinz Surigao, Surigao (*Böttcher*). BASILAN (*Baker*). BOHOL (*Böttcher*). LEYTE, Santa Cruz (*Böttcher*). SAN MIGUEL (Provinz Samar) (*Böttcher*). BUCAS GRANDE, Socorro (*Böttcher*). Zahlreiche Exemplare. Typen in meinem Besitz.

Die Trennung von *continens* ist sehr schwierig und nur durch Penisuntersuchung festzustellen. Als ein wichtiges Merkmal ist die Behaarung der Fühler anzusehen: bei *continens* einzeln, lang, robust, bei *fraudulentus* dicht, kurz, zart. Im allgemeinen sind die dunklen Partieen, namentlich auf den Elytren, heller und können als Artmerkmal herangezogen werden.

Plateros quadraticollis sp. nov.

Mann.—Abdomen und Metasternum dunkelbraun, Prosternum gelb, Vorder- und Mittelbeine mit teilweise gelbroten Schenkeln, sonst braun, Hinterbeine ganz braun, Fühler desgleichen, Prothorax braun mit hellen Rändern, Schildchen braun, Elytren von gleicher Farbe, nur am Humerus etwas heller; überall glänzend. Stirn so breit wie ein Augenhalbmesser, breit, flach eingedrückt. Fühler robust, vom dritten bis zehnten Glied gezähnt, Behaarung lang. Prothorax, Tafel 2, Fig. 14. Punktierung nur am Vorderrand, Diskus platt eingedrückt, Behaarung überall sehr einzeln. Auf den Elytren sind Rippen und Gitterung sehr deutlich, nicht durch die schwache Behaarung verdeckt.

Länge, 5 Millimeter; Breite (hum.), 1.5, circa.

BASILAN (*Baker*). Holotypus in meinem Besitz.

Durch den platten, quadratischen Prothorax von allen Arten abweichend. In der Ausfärbung besteht einige Aehnlichkeit mit *tenebrans*. Durch den Penis sicher festzulegen.

Plateros contiguus sp. nov.

Dunkelerdgrau, Prosternum, die Schenkelbasis der Vorderbeine, Kopf, Prothorax, Schildchen, und die Elytren an der Basis in geringem Umfange rotgelb. Stirn breiter als ein Augendurchmesser, lang und tief gefurcht, kaum behaart. Fühlerglieder nur ganz gering gezähnt, kurz behaart.

Länge, 6 Millimeter; Breite (hum.), 1.5.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*), 1 Mann. Typus in meinem Besitz.

Mit *conspicuus* nahe verwandt, durch den Penis, der von bedeutender Länge und ganz abweichend gebaut ist, verschieden.

Plateros fraterculus sp. nov.

Schwarzbraun, Prothorax an den Rändern und die Elytren im basalen Viertel bis Drittel gelblichweiss. Stirn über den Fühlern flach, beulig, schräg verdickt, über den Beulen mit flachem, mittlerem Eindruck, Skulptur gering; glänzend. Drittes Fühlerglied etwas länger als das vierte, viertes bis zehntes etwa gleichlang, schmal, vom dritten ab etwa doppelt so lang wie breit, schwach gezähnt, behaart. Prothorax breiter als lang, Vorderrand rund, Vorderecken stumpf, deutlich, Seiten- und Hinterrand gerade, Hinterecken fast rechtwinklig, Mittelfurche nur an der Basis, kurz, tief, Punktierung an den Rändern grob, tief, Behaarung gering; glänzend. Schildchen hinten gerade, schwarz, schwach behaart. Elytren mit sehr deutlicher Skulptur, Rippen schmal, Gitterung gross, mittelmässig tief, Behaarung einzeln, lang.

Länge, 4.5 bis 5 Millimeter; Breite (hum.), 1.2, circa.

LUZON, Subprovinz Benguet, Baguio (*Baker*), 2 Männer. Holotypus in meinem Besitz.

Aehnlichkeit besteht mit *cuneatus; fraterculus* ist aber viel kleiner. Auf jeden Fall durch den Penis sicher trennbar.

Bestimmungstabelle der philippinischen Plateros-Arten.

1. Prothorax, Schildchen, und Elytren einfarbig rotgelb, orangerot oder lehmgelb .... 2.
   Elytren wenigstens zum Teil dunkel gefärbt .... 8.
2. Prothorax länger als breit, seitlich parallel, Penis, Tafel 1, Fig. 19; grosse Art .... **P. ordinarius sp. nov.**
   Prothorax quadratisch oder breiter als lang .... 3.
3. Hinterecken des Prothorax obsolet .... 4.
   Hinterecken spitz nach aussen vorgezogen .... 6.
4. Penis wellig geschwungen, Präputium blattartig erweitert (Tafel 1, Fig. 20) .... **P. contortus sp. nov.**
   Penis nicht wellig geschwungen, Präputium nicht erweitert .... 5.
5. Präputium in Aufsicht von unten ohne seitliche Zähnchen (Tafel 1, Fig. 21) .... **P. senex sp. nov.**
   Präputium mit seitlichen Zähnchen (Tafel 1, Fig. 22). **P. pilosus sp. nov.**
6. Penis in Aufsicht von unten mit je einem seitlichen Zahn (Tafel 1, Fig. 24) .... **P. luteolus sp. nov.**
   Penis ohne Zahn .... 7.
7. Fühlerglieder ungezähnt; Penis, Tafel 1, fig. 27 .... **P. generalis sp. nov.**
   Fühlerglieder gezähnt; Penis, Tafel 1, Fig. 28 und 29. **P. lepidus sp. nov.**
8. Sutura und Spitzenteil dunkelgefärbt .... **P. fucosus sp. nov.**
   Sutura nicht dunkelgefärbt, Spitzenteil in mehr oder weniger grossem Umfange dunkel, zuweilen nur die Basis hell oder die Elytren ganz dunkel .... 9.
9. Grössere, schlanke Arten; die hellen Elytrenteile sind von weissgelber Farbe, die dunkle Farbenpartie ist nach der Basis keilförmig zugespitzt .... 10.
   Kleine Arten, die hellen Partieen sind lehmgelb bis lederfarbig, die dunklen sind an der Sutura nicht keilförmig vorgezogen .... 13.
10. Hinterecken des Prothorax stark nach aussen vorgezogen .... 11.
    Hinterecken nicht vorgezogen .... 12.
11. Penis kurz, Basis nicht zwiebelartig verdickt (Tafel 1, Fig. 33 und 34). **P. cuneatus sp. nov.**
    Penis an der Basis zwiebelartig verdickt (Tafel 1, Fig. 36). **P. ponderosus sp. nov.**

12. Penis in der Mitte rechtwinklig gebogen, Präputium scheibig (Tafel 1, Fig. 37) .... **P. luzonicus sp. nov.**
Penis nicht gebogen, Präputium nicht scheibig, in Seitenansicht hakenförmig .... **P. popularis sp. nov.**
13. Die Elytren sind ganz dunkel, höchstens der Prothorax hat helle Ränder .... 14.
Die Elytren sind an der Basis immer mehr oder weniger hell .... 19.
14. Penis mit fadenförmigem Präputium .... 15.
Präputium von anderer Gestalt .... 16.
15. Präputium hakenförmig umgebogen (Tafel 1, Fig. 39). **P. fulgidus sp. nov.**
Präputium wellig, nicht hakenförmig umgebogen (Tafel 1, Fig. 40). **P. tenebrans sp. nov.**
16. Das breite Präputium ist hakenförmig umgebogen und kurz zugespitzt (Tafel 2, Fig. 1) .... **P. triangulus sp. nov.**
Präputium von anderer Gestalt .... 17.
17. Penis lang, in der Mitte dornig vorgebogen, Präputium mit scheibigem Aufsatz (Tafel 1, Fig. 42) .... **P. simillimus sp. nov.**
Penis von ånderer Gestalt .... 18.
18. Präputium in Aufsicht bedeutend verbreitert, mit halbelliptischen Vorderrand (Tafel 1, Fig. 41) .... **P. contrarius sp. nov.**
Penis walzig, Präputium nicht verbreitert (Tafel 2, Fig. 2). **P. contextus sp. nov.**
19. Prothorax und Schildchen gelb, Elytren dunkel .... 20.
Die Elytren immer in mehr oder weniger grossem Umfange hellfarbig .... 21.
20. Grössere Art, nicht unter 6 Millimeter; Präputium mit stumpfen Zahn, dann zugespitzt (Tafel 2, Fig. 4) .... **P. conspiciendus sp. nov.**
Kleinere Art, höchstens 4.5 Millimeter; Präputium löffelförmig (Tafel 2, Fig. 6) .... **P. testaceus sp. nov.**
21. Präputium hakenförmig umgebogen .... 22.
Nicht umgebogen .... 24.
22. Präputium einen kurzen, starken Haken bildend.... **P. conspicuus sp. nov.**
Keinen Haken bildend .... 23.
23. Präputium mit abstehenden Dornen besetzt (Tafel 2, Fig. 8). **P. bakeri sp. nov.**
Präputium ohne Dornen (Tafel 2, Fig. 10) .... **P. constans sp. nov.**
24. Penis im vorderen Drittel umgebogen (Tafel 2, Fig. 11). **P. continens sp. nov.**
Penis nicht umgebogen .... 25.
25. Prothorax mit vorgezogenen, spitzen Hinterecken, Penis keulig (Tafel 2, Fig. 12) .... **P. fraudulentus sp. nov.**
Prothorax ohne vorgezogene Ecken .... 26.
26. Prothorax mit gerundeten Ecken; Penis, Tafel 2, Fig. 15. **P. quadraticollis sp. nov.**
Prothorax mit kantigen Ecken .... 27.
27. Penis pfeilförmig, nicht gedreht, Präputium etwas verdickt. **P. contiguus sp. nov.**
Penis nicht pfeilförmig, in der Mitte verbreitert, gedreht, Präputium spitz .... **P. fraterculus sp. nov.**

Genus **DITONECES** Waterhouse

Ditoneces WATERHOUSE, Ill. Typ. Spec. Col., Lycidæ 1 (1879) 31.

Bisher nur aus dem orientalischen Gebiet bekannt. Wie *Plateros*, ist auch *Ditoneces* von äusserst uniformem Habitus. Auf die Schwierigkeit der Bestimmung weiblicher Individuen und die zuweilen unmögliche Trennung von *Plateros* habe ich schon hingewiesen. Die Männer mit ihren pectinaten Fühlern geben ein hinreichendes Charakteristikum, auf dem die Gattung festzulegen ist, ab. Der Penis ist genau so vielgestaltig wie bei *Plateros*.

Ditoneces philippinensis Bourgeois.

Ditoneces philippinensis BOURGEOIS, Ann. Soc. Ent. Fr. VI 6 (1886) 181.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*): Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*). BUCAS GRANDE, Socorro (*Böttcher*). MINDANAO, Provinz Davao, Davao: Provinz Surigao, Surigao: Provinz Lanao, Iligan (*Baker*).

Im männlichen Geschlecht waren nur die Fühler variabel, die in der Länge verschieden sein können, das Verhältnis der Lamellen zur Gliedlänge bleibt aber. Die Weiber variieren viel stärker; die Fühler haben zuweilen die Gestalt wie in Tafel 2, Fig. 19, können aber auch deutlich kleine Lamellen haben. Ebenso ändert der Prothorax ab, der länglich und ohne scharfe Hinterecken sein kann, manchmal aber der männlichen Form, die immer mehr breit als lang ist und spitze Hinterecken hat, ähnlich wird. Die sichere Bestimmung ist nicht leicht.

Ich habe diese Art in dem grossen Material das ich sah, nicht gerade häufig angetroffen. Sie ist durch ihre Grösse kenntlich und ist nach Bourgeois's Diagnose auch zu erkennen. Mir lagen Exemplare vor, die Pic mit Bourgeois's Type verglichen hatte. Ich lege nun auch den Penis fest, damit es in Zukunft möglich ist, die Art sicher zu erkennen, denn es ist nicht ausgeschlossen, dass sich noch ähnliche, leicht verwechselnde Arten finden werden.

Ditoneces afflictus sp. nov.

Mann.—Lehmgelb, Beine mit Ausnahme der Basis der Vorderschenkel, Fühler und Abdomen erdbraun; am ganzen Körper behaart; glänzend. Kopf auf der Stirne so breit wie ein Augenhalbmesser, am Uebergang zum Scheitel mit zwei grubigen Vertiefungen, Punktierung äusserst obsolet, kaum sichtbar. Fühler denen von *aestimabilis* ähnlich, die Lamellen aber gerade. Prothorax gleich *aemulus*. Schenkel gewölbt, nicht eingedrückt. Penis, Tafel 2, Fig. 21.

Weib.—Fühlerglieder länger als breit, schwach gezähnt, dicht behaart.

Länge, 6.75 bis 10 Millimeter; Breite (hum.), 2 bis 3.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*). MINDANAO, Provinz Davao, Davao: Provinz Surigao, Surigao: Provinz Bukidnon, Tangkulan: Provinz Agusan, Butuan: Provinz Lanao, Kolambugan; Iligan (*Baker*); Momungan (*Böttcher*): Provinz Zamboanga, Dapitan (*Baker*). MINDORO, Calapan (*Böttcher*). NEGROS, Cuernos Gebirge (*Baker*). SAMAR (*Baker*). Circa 100 Exemplare gesehen. Typen in meinem Besitz.

Im männlichen Geschlecht ist die Variation nur gering, die Weiber variieren stärker insofern als der Prothorax scharfe Hinterecken haben kann oder nicht; die Grundform des Prothorax kann zuweilen recht lang werden.

Die Ausfärbung der Oberseite ist recht konstant, die dunklen Partieen der Unterseite und der Extremitäten sind aber erheblichen Abweichungen unterworfen, unreife Tiere sind ganz hell.

Ditoneces consociatus sp. nov.

Habituell mit *philippinensis* übereinstimmend, etwas röter in Farbe. Kopf gleich *afflictus*. Fühler des Mannes mit kräftigen Lamellen, die doppelt so lang wie das Glied sind und nach vorn breiter werden; Behaarung kurz, nur einzelne Haare sind länger; Fühler des Weibes kräftig gezähnt, die basalen Glieder mit kurzen Lamellen. Prothorax in beiden Geschlechtern mit spitzen Hinterecken. Penis schlank, hyalin, in der Mitte gedreht, mit pigmentierter Mittellinie.

Länge, 7 bis 9 Millimeter; Breite (hum.), 2 bis 2.5.

MINDANAO, Provinz Agusan, Butuan (*Baker*), 3 Männer, 4 Weiber. Typen in meinem Besitz.

Die Variationsgrenzen sind sehr eng.

Ditoneces consonus sp. nov.

Von *consociatus* habituell nur durch den Prothorax verschieden, dessen Hinterecken nicht spitz, sondern abgerundet sind. Penis von gänzlich anderer Form.

Länge, 8 Millimeter; Breite (hum.), 2.

MINDANAO, Provinz Lanao, Iligan (*Baker*), 1 Mann. Typus in meinem Besitz.

Das typische Exemplar ist in der Ausfärbung etwas dunkler als *consociatus,* es bleibt abzuwarten, ob es sich um eine Arteigentümlichkeit handelt.

Ditoneces affinis sp. nov.

Einfarbig schwarz, nur der Prothorax in den Seitenpartieen gelblich, am ganzen Körper glänzend. Stirn zwischen den Augen so breit wie ein Augendurchmesser, gewölbt, einzeln punktiert und behaart. Lamellen der mittleren Fühlerglieder schmal, seitlich stark zusammengedrückt, doppelt so lang wie das Glied selbst, Behaarung kurz, nur einzelne längere Haare sind vorhanden. Prothorax vorn gerundet, seitlich stumpf umgebogen, Seiten schräg nach aussen erweitert, nicht gewellt, Hinterrand schwach wellig, die Aussenecken kräftig nach innen vorgezogen, Mittelkiel am Vorderrand fehlt, Punktierung an den Rändern tief, Behaarung kurz. Unterseite des Körpers und die Beine dicht, kurz behaart. Schenkel gewölbt, nicht eingedrückt.

Länge, 8 Millimeter; Breite (hum.), 2.2, circa.

LUZON, Provinz Laguna, Mount Maquiling; Mount Banahao (*Baker*) ; Los Baños (*Böttcher*) : Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*). MINDORO, Mount Halcon (*E. D. Merrill*) ; Calapan (*Böttcher*) ; 20 Weiber. Holotypus im Dresdener Museum; Cotypus in meinem Besitz.

Die Art ist nicht gerade selten. Sie ist durch die Konstanz ihrer Farben ausgezeichnet und hat sehr enge Variationsgrenzen.

Ditoneces alienus sp. nov.

Kleine, zierliche Art, graubraun, nur der Prothorax, namentlich an den Seiten, und die Basis der Vorderschenkel hellgelbbraun, Behaarung und Glanz normal. Stirn breiter als ein Augendurchmesser, flach eingedrückt. Fühler zart, Lamellen kürzer als das Glied selbst, sehr lang behaart, drittes Glied gedrungen, Lamellen sehr kurz, nach der Spitze zu werden die Glieder schmäler und die Lamellen kürzer. Prothorax in der Form von *aestimabilis.* Elytren in den Furchen punktiert, die Punktierung nicht durch die Behaarung verdeckt. Schenkel eingedrückt, nicht gewölbt. Penis, Tafel 2, Fig. 31 und 32. Präputium in Aufsicht sehr schmal, in Seitenansicht zungenförmig, hyalin, sonst kräftig pigmentiert.

Länge, 4 Millimeter; Breite (hum.), 1.5.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*) ; Los Baños (*Böttcher*) ; 5 Männer, 1 Weib. Typen im Dresdener Museum und in meinem Besitz.

Die Variationsbreite ist gering und erstreckt sich auf Aufhellung des Prothorax, der bis schmutzig-gelbbraun werden kann.

Ditoneces promiscuus sp. nov.

Erdbraun, Prothorax braun mit gelben Rändern, Schildchen braun, Elytren mit Ausnahme des basalen Drittels gelb. Kopf und Stirn gerade, senkrecht, über den Fühlerbeulen mit zwei tiefen Punkten, Punktierung sehr fein, Behaarung kurz, anliegend. Mittlere Fühlerglieder, Tafel 2, Fig. 33. Drittes und viertes Glied mit kurzer Lamelle, einzeln, lang behaart. Prothorax quadratisch, Vorderrand rundlich abfallend, Vorderecken gerundet, Seiten gerade, gegen die etwas vorgezogenen Hinterecken erweitert, Hinterrand nach innen geschwungen, Punktierung am Rande einzeln, Behaarung anliegend. Elytren mit deutlicher Gitterung, Behaarung aus dichter, filziger Unterbehaarung und einzelstehenden langen Haaren bestehend.

Länge, 5 Millimeter; Breite (hum.), 1.75, circa.

MINDANAO, Provinz Lanao, Momungan (*Böttcher*), 11 Männer. Holotypus im Museum Natura Artis Magistra; Cotypus in meinem Besitz.

Durch die schmalen, langen Fühlerlamellen von allen anderen ähnlichen Arten unterschieden. Die Dunkelfärbung auf den Elytren geht zuweilen nicht an den Rändern hoch, sonst sind die Variationen gering. Der Penis erinnert an *conterminus*, mit der auch sonst nähere Verwandtschaft zu bestehen scheint.

Ditoneces pusillus Bourgeois.

Ditoneces pusillus BOURGEOIS, Ann. Soc. Ent. Fr. VI 6 (1186) 181.

Mann.—Dem *aemulus* sehr ähnlich, durch folgende Merkmale sicher unterschieden: Die Stirn ist doppelt so breit als das von oben gesehene Auge, gewölbt, nicht vertieft, erst über den Fühlern wellig eingedrückt, zwischen den Fühlern wieder gewölbt. Lamellen an den mittleren Fühlergliedern lang und schmal, kurz behaart. Schenkel flach eingesunken. Penis, Tafel 2, Fig. 38 und 39.

Weib.—Fühler gedrungen, nur wenig gezähnt, vom dritten ab etwa gleichlang, nach vorn schmäler werdend, dicht behaart.

Länge, 5 bis 7 Millimeter; Breite (hum.), 1.5 bis 1.8.

MINDANAO, Provinz Davao, Davao: Provinz Surigao, Surigao (*Baker*) : Provinz Zamboanga, Port Banga (*Böttcher*) ; Dapitan (*Baker*) : Provinz Agusan, Cabadbaran (*Weber*) : Provinz Lanao, Kolambugan (*Banks*) ; Iligan (*Baker*) ; Momungan (*Böttcher*). BASILAN (*Baker*). NEGROS, Cuernos Gebirge (*Baker*).

Gegen den sehr ähnlichen *contemptus* durch die längeren Lamellen an den Fühlern sicher und leicht zu trennen; die sichere Bestimmung der weiblichen Tiere ist schwierig.

Ditoneces aestimabilis sp. nov.

Gehört zur *aemulus*-Gruppe. Prothorax, Schildchen, Elytren bis dicht vor der Spitze hellgelblich, Pro- und Metasternum und die Vorderschenkel an der Basis gelblich, Kopf, Fühler, und die Beine erdbraun, Elytren am Hinterrand schwarz. Stirn ohne Grube, aber mit deutlicher Längsfurche. Lamellen der männlichen Fühlerglieder kaum so lang wie das Glied selbst, rundlich; abstehend, einzeln, lang behaart. Prothorax nicht trapezoid, Vorderrand gerundet, seitlich rund umgebogen, Seiten gerade, Hinterrand desgleichen, Aussenecken spitz, Kiel im Vorderteil fehlt, sonst wie bei den vorigen Arten. Schenkel schwach eingesunken.

Länge, 5.5 Millimeter; Breite (hum.), 1.5 circa.

MINDANAO, Provinz Lanao, Momungan (*Böttcher*). BASILAN (*Baker*). PALAWAN, Puerto Princesa (*Baker*). Mehrere Männer. Holotypus im Dresdener Museum, Cotypus in meinem Besitz.

Es ist eine der wenigen Arten, die auf den Philippinen und Palawan vorkommen. Die Tatsache ist beachtenswert, da noch festzustellen ist, ob es sich um eine Endemisme handelt, oder ob die Art aus dem westlichen Teil des orientalischen Gebietes stammt.

Ditoneces conterminus sp. nov.

Metasternum und Abdomen dunkelbraun bis schwarz, Beine und Prosternum gelblich bis hellbraun, Kopf und Fühler dunkelbraun, Prothorax, Schildchen, und Elytren in der basalen Hälfte schmutzig-lehmgelb, Spitzenhälfte schwarz. Kopf breit und flach eingebuchtet, einzeln, lang behaart. Fühler gleich *aestimabilis* aber viel stärker und länger behaart. Prothorax breiter als lang, Vorderrand gerundet, an den Seiten scharf umgebogen, Seiten gerade, schräg nach aussen gerichtet, Hinterecken spitz vorgezogen, an den Vorderecken und am Hinterrand tief eingesenkt, Punktierung nur am Vorder- und Hinterrand stärker, Behaarung sehr schwach.

Länge, 4.5 bis 6 Millimeter; Breite (hum.), 1.25 bis 1.5, circa.

MINDANAO, Provinz Surigao, Surigao (*Baker*) : Provinz Agusan, Cabadbaran (*Weber*) ; Agusan River (*Weber*). BASILAN

(*Böttcher.*) MASBATE, Aroroy (*Böttcher*); 6 Männer und 8 Weiber. Typen in meinem Besitz.

Es handelt sich um eine kleine Art, Variation gering. Wie alle *Ditoneces* mit dunkler Elytrenspitze, ist auch *conterminus* nur nach dem Begattungsapparat sicher zu bestimmen.

Ditoneces continuus sp. nov.

In der Ausfärbung *D. conspectus* Kleine gleich, aber durch die abweichende Gestalt der Fühler und des Prothorax, vor allen Dingen durch den Penis, sicher geschieden. Stirn so breit wie ein Augendurchmesser, flach grubig vertieft, behaart. Fühler sehr zart, Lamellen halb so lang wie das Glied selbst, einzeln und lang behaart. Prothorax gleich *conterminus*. Penis robust, zweimal gedreht, Basalteil schmal, rundlich, sonst platt, Tafel 2, Fig. 45.

Länge, 6 Millimeter; Breite (hum.), 1.5.

MINDANAO, Provinz Surigao, Surigao: Provinz Lanao, Kolambugan (*Baker*); 2 Männer. Holotypus in meinem Besitz.

Ditoneces pilosicornis Blanchard.

Ditoneces pilosicornis BLANCHARD, Voy. Pole Sud 4: 79, t. 5, f. 14.

Schwarzbraun, Prothorax, Schildchen, und Elytren mit Ausnahme der äussersten Spitze orangerot. Stirn so breit wie ein Augendurchmesser, breit, grubig vertieft, zart skulptiert. Fühler des Mannes pectinat, Lamellen kürzer als das Glied, lang behaart, Fühler des Weibes kräftig gezähnt, kurz behaart. Prothorax am Vorderrand steil dachförmig abfallend, Seiten und Hinterrand flach geschwungen, Hinterecken prominent, am Vorderrand mit kurzem stumpfem Kiel, hinten kurz, tief eingedrückt, an den Rändern mit einfacher, tiefer Punktreihe, Behaarung wenig dicht, anliegend. Elytren dicht behaart. Penis, Tafel 2, Fig. 47.

Länge, 6.5 bis 7 Millimeter; Breite (hum.), 1.75, circa.

MINDANAO, Provinz Lanao, Kolambugan: Provinz Davao, Davao: Provinz Surigao, Surigao: Provinz Agusan, Butuan: Provinz Zamboanga, Zamboanga (*Baker*).

Die schwarze Partie auf den Elytren bleibt immer klein und beschränkt sich ganz auf den Rand. Bei Ausdehnung schreitet sie zunächst an der Sutura fort. Ohne Penisautopsie von verwandten Arten nur schwer trennbar.

Ditoneces aemulus sp. nov.

Prothorax, Schildchen, Elytren bis hinter der Mitte ziegelrot, sonst schwarz, Schenkel an der Basis hellbraun. Stirn höchstens so breit wie das von oben gesehene Auge, vor dem Prothoraxrand flach dreieckig vertieft, zwischen den Fühlern mit flacher Mittelrinne, goldgelb behaart. Fühler des Mannes mit kurzen, zarten, keilförmigen Lamellen, stark und lang borstig behaart. Prothorax trapezoid, am Hinterrand breiter als lang, Vorderrand schräg, Ecken stumpf, Seiten schwach nach innen geschwungen, Hinterrand wenig gebogen, Hinterecken spitz, nach hinten vorgezogen, Mittelfurche an der Basis tief, dreieckig, Kiel am Vorderrand kurz, scharf, schmal, am ganzen Rand mit einer groben, tief eingesenkten Punktreihe, Behaarung dicht. Elytren dicht und kurz behaart. Schenkel gewölbt. Penis, Tafel 2, Fig. 49 und 50.

Weib in üblicher Weise unterschieden.

Länge, 6 Millimeter; Breite (hum.), 2 Millimeter, circa.

MINDANAO, Provinz Surigao, Surigao: Provinz Agusan, Butuan (*Baker*). Typen im Dresdener Museum, Cotypen in meinem Besitz.

Von ähnlichen Arten nur durch den Penis trennbar.

Bestimmungstabelle der philippinischen Ditoneces-Arten.

1. Elytren ganz gelb oder orangerot .... 2.

Elytren ganz oder zum Teil braun oder schwarz .... 5.

2. Penis pfeilförmig (Tafel 2, Fig. 20) .... **D. philippinensis Bourgeois.**

Penis nicht pfeilförmig .... 3.

3. Penis mehrfach winklig gebogen (Tafel 2, Fig. 21). **D. afflictus sp. nov.**

Penis nicht umgebogen .... 4.

4. Prothorax mit spitzen Hinterecken; Penis, Tafel 2, Fig. 23. **D. consociatus sp. nov.**

Prothorax mit runden Hinterecken; Penis, Tafel 2, Fig. 25. **D. consonus sp. nov.**

5. Elytren schwarz, nur der Prothorax an den Seiten gelb .... 6.

Elytren wenigstens in der basalen Hälfte rotorange oder lehmgelb.... 7.

6. Grössere, circa 8 Millimeter grosse Art, tiefschwarz, nur der Prothorax an den Seiten rotgelb; Fühlerlamellen lang; Penis, Tafel 2, Fig. 28 und 29 .... **D. affinis sp. nov.**

Prothorax an allen Rändern schmal gelb .... **D. alienus sp. nov.**

7. Lamellen der männlichen Fühlerglieder an den mittleren Gliedern wenigstens so lang wie das Glied selbst .... 8.

Kürzer als das Glied selbst .... 9.

8. Penis löffelförmig (Tafel 2, Fig. 35) .... **D. promiscuus sp. nov.**

Penis nicht löffelförmig, Präputium trapezoid (Tafel 2, Fig. 38 und 39). **D. pusillus Bourgeois.**

9. Penis ringförmig zusammengedreht (Tafel 2, Fig. 42). **D. aestimabilis sp. nov.**

Penis von anderer Gestalt .... 10.

10. Präputium löffelförmig verbreitert (Tafel 2, Fig. 43). **D. conterminus sp. nov.**

Präputium spitz .... 11.
11. Penis mehrfach gedreht (Tafel 2, Fig. 45)............ **D. continuus sp. nov.**
Penis nicht gedreht .... 12.
12. Penis in Seitenansicht mit spitzem Präputium, die schwarzen Partieen auf den Elytren sind nur klein und liegen dicht am Hinterrand.
D. pilosicornis Blanchard.
Präputium zungenförmig, die schwarzen Flecken auf den Elytren wenigstens das Spitzendrittel einnehmend........................ **D. aemulus sp. nov.**

Genus SUBDIHAMMATUS novum

Schlank, zart. Stirn abschüssig, breit, drei bis viermal so breit wie ein Auge in Aufsicht von oben, an den Fühlern mit grossen, breiten, wulstigen Verdickungen, Maxillen mittelgross, übereinandergeschlagen, Maxillarpalpen klein, letztes Glied kegelig. Fühler schlank, zweites und drittes Glied klein, kugelig, das vierte länger als das fünfte, die folgenden etwa gleichlang, nach der Spitze schmäler werdend, das elfte länger als das zehnte, überall mittellang, abstehend, dicht behaart. Prothorax gleich *Dilophotes*. Schildchen langdreieckig, hinten eingeschnitten. Elytren mit vier kräftigen Primärrippen, dazwischen eine undeutliche Rippe, Gitterung kräftig. Beine gleich *Dilophotes*. Am ganzen Körper zottig behaart.

Typus der Gattung, *S. curvus* sp. nov.

Subdihammatus curvus sp. nov.

Einfarbig schwarzbraun, Beine heller, am ganzen Körper mässig glänzend.

Länge, 4.5 Millimeter; Breite (hum.), 1, circa.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*). Typus (Weib) in meinem Besitz.

Die Gattung liegt zwischen *Dilophotes* und *Dihammatus*. Mit ersterer hat sie die Gestalt des Prothorax und der Beine gemeinsam, auch die vier erhöhten Rippen erinnern daran, mit *Dihammatus* stimmen die Fühler überein. Der Kopf und die Gitterung der Elytren, ferner die eigenartige, robuste Behaarung ist nur der neuen Gattung eigen. Die Form des Begattungsapparates ist bei keiner der genannten Gattungen zu finden, erinnert dagegen an *Conderis*, wo derartige Penisformen vorherrschen.

Genus DIHAMMATUS Waterhouse

Dihammatus WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 29.

Die Gattung ist orientalisch. Von den vier Arten die ich von den Philippinen sah, sind zwei auf Palawan gefunden worden und, wie nicht anders zu erwarten, auch auf Borneo; *pallens*

Waterhouse ist nicht bis zu den Philippinen vorgedrungen, sondern nur auf Palawan gefunden; die zweite Art, *abditus* sp. nov., fand sich aber auf Palawan und den anderen Inseln selbst; zwei sind nur von den Philippinen bekannt.

Der Habitus ist sehr einförmig, die Variation nur gering; *abditus*, *abjectus*, und *orientalis* haben denselben Penis, sind aber sonst hinreichend verschieden um die Artsicherheit zu garantieren. Die Verwandtschaft dieser drei Arten ist also recht gross.

Dihammatus abditus sp. nov.

Parallel, plattgedrückt, mittelstark glänzend, dicht und kurz behaart, erdbraun, Prothorax und Elytren im vorderen Viertel hellgelbbraun. Stirn zwischen den Fühlern mit tiefer Mittelfurche. Prothorax in der basalen Hälfte gefurcht, nach vorn glatt, an den Seiten tief, einzeln, grob punktiert. Erstes Fühlerglied robust, dick, zweites und drittes kurz, gleichlang, viertes bis elftes von gleicher Länge, aussen etwas gezähnt, jedes Glied so lang wie das zweite und dritte zusammen. Elytren gitterfurchig, Beine erdbraun, hell, Trochanteren der Hinterbeine dreieckig erweitert. Körper dunkelbraun, Metasternum gegen das Abdomen zapfenartig vorgezogen.

Länge, 4 Millimeter; Breite (hum.), 1.3, circa.

MINDANAO, Provinz Lanao, Iligan: Provinz Zamboanga, Dapitan (*Baker*). PALAWAN, Puerto Princesa (*Baker*). BORNEO, Sandakan (*Baker*).

Durch die grobe Punktierung des Prothorax von allen bisher bekannten Arten verschieden. Die Borneenser unterscheiden sich von den Philippinern nicht. Die Variationsbreite der Art ist im allgemeinen gering.

Dihammatus abjectus sp. nov.

Mit *abditus* verwandt. Einfarbig pechbraun. Stirn mit flacher Mittelfurche, am Scheitel knotig verdickt. Prothorax am Hinterrand geschwungen, nicht gerade, basale Furche tief, keilförmig, am Hinterrand verbreitert, vor der Furche hoch gekielt, Punktierung rugos, tief, nur am Vorderrand und neben dem Kiel vorhanden. Elytren gleichmässig gitterfurchig. Metasternum nicht zapfenartig verlängert; sonst gleich *abditus*.

Länge, 5.5 Millimeter; Breite (hum.), 1.5.

LUZON, Provinz Laguna, Mount Banahao, 2,000 Fuss (*Baker, Böttcher*): Mount Maquiling (*Baker*). SAN MIGUEL (Provinz Samar) (*Böttcher*). MINDORO, Calapan (*Böttcher*). Typen im Dresdener Museum, Cotypen in meinem Besitz.

Dihammatus abjectus ist von der vorhergehenden Art leicht trennbar. Von dem einfarbigen Körper abgesehen, unterscheidet die Punktierung des Prothorax, die nicht an den Seiten, sondern in der Nähe des Mittelkiels, also vorn vorhanden ist. Der Prothorax ist am Hinterrand kräftig geschwungen, nach den Aussenecken spitz, im Gegensatz zu *abditus*, wo der Rand gerade ist und die Ecken stumpf bleiben.

Dihammatus orientalis sp. nov.

Abdomen, Beine mit Ausnahme der basalen Schenkelhälfte und Fühler braun, sonst gelblich, gelb behaart. Stirn keilförmig, zwischen den Augen vertieft, punktiert und behaart. Zweites und drittes Fühlerglied gleichlang, viertes Glied so lang wie das zweite und dritte zusammen, fünftes kürzer als das vierte, fünftes bis elftes gleichlang. Prothorax, Tafel 2, Fig. 56. Schildchen flach nach innen gebuchtet. Rippen und Gitterung auf den Elytren durch dichte Behaarung verdeckt.

Länge, 5 Millimeter; Breite (hum.), 1.5, circa.

LUZON, Subprovinz Benguet, Baguio (*Baker*). MINDANAO, Provinz Surigao, Surigao (*Baker*).

Penis wie bei *abjectus*, trotzdem sind die beiden Arten nicht identisch. Ich habe von beiden eine ganze Reihe von Individuen gesehen; *abjectus* ist immer pechbraun, *orientalis* hellgelb. Der Prothorax ist im Verlauf des Vorderrandes bei beiden Arten verschieden. Die Verwandtschaft ist aber sehr nahe; hätten mir irgendwelche Uebergangsformen vorgelegen, so hätte ich ohne Weiteres beide Arten vereinigt.

Dihammatus pallens Waterhouse.

Dihammatus pallens WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 29, t. 7, f. 7, 7a.

PALAWAN, Iwahig (*Weber*). BORNEO, Sarawak (*Wallace*).

Der komplizierte Penis, Tafel 2, Fig. 57. Es liegt hier eine ganz andere Verwandtschaftsreihe vor, als bei den Philippinern.

Bestimmungstabelle der philippinischen Dihammatus-Arten.

1. Einfarbig pechbraune Arten........ 2.
   Wenigstens zum Teil dunkel lehmgelb........ 3.
2. Prothorax am Vorder- und Seitenrand tief, grob punktiert. **D. abditus** sp. nov.
   Prothorax nur am Vorderrand punktiert........ **D. abjectus** sp. nov.
3. Prothorax, Schildchen, und Elytren mehr oder weniger schmutzig-gelb, letztere zuweilen mit dunklem Spitzenteil in wechselnder Ausdehnung, Penis gleich *abjectus*........ **D. orientalis** sp. nov.

Prothorax, Schildchen, und Basis der Elytren hellgelb, sonst graubraun; Penis, Tafel 2, Fig. 57 .... **D. pallens** Waterhouse.

Genus **LIBNETIS** Waterhouse

Libnetis WATERHOUSE, Trans. Ent. Soc. London (1878) 104.

Die Gattung ist im orientalischen Gebiet weit verbreitet. Die philippinischen Arten sind, mit Ausnahme von *commendabilis*, schwer zu unterscheiden und nur durch Penisautopsie sicher festzulegen. Da das Organ sehr weich ist, so ist bei Präparation sorgfältiges Aufweichen notwendig. Die Untersuchung muss im Wassertropfen stattfinden. Von mehreren Arten sah ich genügend Material um über die Variationsgrenzen Aufschluss zu bekommen. Im allgemeinen muss mit ziemlicher Variation gerechnet werden. Es scheint als ob sich die Gattung stark im Zustand der Aufspaltung befindet.

Libnetis commendabilis sp. nov.

Mann.—Einfarbig grauschwarz. Kopf ohne Mittelfurche. Fühler ungezähnt, vom dritten Gliede ab 2.5 bis 3 mal länger als breit, kurz behaart. Prothorax quadratisch, Vorderrand flach gerundet, Vorderecken rundlich, Seiten gerade, Hinterrand kaum gebogen, Hinterecken spitz aber wenig vorgezogen, Ränder nicht erhöht, dicht, kammborstig behaart, der basale Eindruck breit, dreieckig, allgemeine Behaarung schwach, daher stark glänzend. Elytren mit vier Rippen, die erste nur in der basalen Hälfte, durch rugose Skulptur und dichte Behaarung werden die Rippen stark verdeckt.

Weib.—Fühler etwas kürzer, sonst wie beim Mann.

Länge, 4 bis 5 Millimeter; Breite (hum.), 1.5, circa.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*): Provinz Laguna, Mount Maquiling (*Baker*); Los Baños (*Baker*): Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*): Provinz Sorsogon, Mount Bulusan (*Böttcher*): Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*): Subprovinz Kalinga, Lubuagan (*Böttcher*). MINDANAO, Provinz Lanao, Iligan: Provinz Zamboanga, Zamboanga (*Baker*). Circa 200 Exemplare gesehen. Typen in meinem Besitz.

Im Dresdener Material sah ich mehrere Männer von Iligan und Zamboanga, die habituell von *commendabilis* nicht zu trennen waren und nur andere Färbung hatten. Sie waren auf der Körperunterseite teilweise grauschwarz wie die Nominatform oder auch heller gelblich, Prothorax und Schildchen waren gleichfalls grau. Die Elytren hatten nur das Spitzendrittel verdunkelt, sonst waren sie hell, gelblich. Die Untersuchung des Begattungsapparates ergab sichere Zugehörigkeit zu *commendabilis*. Vielleicht liegen lokale Abweichungen vor. Die Stücke von Mount Banahao und Los Baños sind sehr viel heller als von anderen Fundorten; der Penisvergleich hat die Identität der Art ergeben. Ohne Penisuntersuchung ist die Art nicht sicher zu bestimmen.

Sehr merkwürdig ist das häufige Vorkommen auf Luzon gegenüber anderen Inseln. Selbst die Exemplare von Mindanao sind mit Skeptizismus zu begegnen, vielleicht handelt es sich um eine eigene Art.

Libnetis gracillimus sp. nov.

Mann.—Unterseite des Körpers schwärzlich, Beine und Fühler braun, Prothorax schwarz, nur die Aussenränder und der Hinterrand zum Teil lehmfarbig; Schildchen braunschwarz, Elytren mit Ausnahme des schwarzen Spitzendrittels hell, lehmfarbig. Fühler ungezähnt, vom dritten Glied ab wenigstens doppelt so lang wie breit, zart behaart. Prothorax (Tafel 2, Fig. 61), Punktierung nur am Vorderrand deutlich, Mittelfurche an der Basis kurz und breit dreieckig, der davorliegende Mittelkiel schmal, scharfkantig. Elytren mit drei Rippen, die erste, der Sutura am nächsten liegende, ganz fehlend; Behaarung einzeln.

Länge, 4 Millimeter; Breite (hum.), 1.2, circa.

MINDANAO, Provinz Zamboanga, Zamboanga (*Baker*). Holotypus in meinem Besitz.

Mit *debilis* am nächsten verwandt, habituell nicht zu unterscheiden, nur ist auf den Elytren die erste Rippe deutlich entwickelt. Der Penis ist bei beiden Arten grundverschieden und sichert die Artberechtigung.

Libnetis bardus sp. nov.

Dunkelbraun, nur die Elytren in der basalen Hälfte gelblichweisslich, zuweilen sind die Hinterecken des Prothorax hell. Stirn breiter als ein Augendurchmesser, breit, flach eingedrückt, ohne Skulptur, unbehaart. Fühler des Mannes schlank; vom dritten Gliede ab sind die Glieder drei bis viermal so lang wie breit, kräftig, mittellang behaart und warzig skulptiert, des Weibes robuster, ungezähnt, 2.5 mal so lang wie breit, dicht behaart. Prothorax breiter als lang, Hinterecken spitz vorgezogen, Kiel am Vorderrand fehlend, Areole in der hinteren Hälfte schmal und tief, Punktierung am Vorderrand rugos und ausgedehnt, an den Seiten und am Hinterrand weniger stark.

Schildchen glatt. Elytren mit vier flachen, aber deutlichen Rippen, Behaarung kurz, zart.

Länge, 7.5 Millimeter; Breite (hum.), 2, circa.

LUZON, Subprovinz Benguet, Baguio (*Baker*); Pauai (Haight's Place) (*Böttcher*); 2 Männer, 2 Weiber. Typen in meinem Besitz.

Mit keiner anderen Art zu verwechseln; Grösse, Ausfärbung, und Gestalt der Fühler trennen sehr leicht. Im Zweifelsfalle muss der Penis entscheiden.

Libnetis coloratus sp. nov.

Mann.—Graubraun, nur die Elytren im vorderen Drittel bleichgelb. Kopf nicht gefurcht. Fühlerglieder schwach gezähnt, 2.5 bis 3 mal so lang als breit, warzig skulptiert und überall abstehend behaart, Behaarung ansehnlich und dicht. Prothorax breiter als lang, alle Ränder flach, nicht über die Grundfläche erhaben, basale Vertiefung kurz, breit, tief, Hinterecken nur schwach vorgezogen, Punktierung vorn und an den Seiten tief, rugos. Elytren mit vier nur wenig erhöhten Rippen, die durch kurze Behaarung noch undeutlicher werden. Penis, Tafel 3, Fig. 6 und 7.

Länge, 6 Millimeter; Breite (hum.), 1.75.

MINDANAO, Provinz Zamboanga, Dapitan (*Baker*). Typus in meinem Besitz.

Die Art unterscheidet sich leicht durch die langgliedrigen, langbehaarten Fühler, die ich noch bei keiner Art gesehen habe. Der Begattungsapparat ist von den bisher untersuchten Arten stark abweichend, so dass *coloratus* als eine leicht und sicher festzustellende Art gelten muss.

Libnetis defectus sp. nov.

Mann.—Erdgrau, die Beine und Elytren, namentlich in der Basalgegend, durch helle Behaarung gelbbraun. Stirn kaum so breit wie ein Augendurchmesser, von Auge zu Auge über den Fühlern eingedrückt, so dass die Fühlerbeulen auffallend stark hervorstehen, dicht, hell behaart. Fühler sehr schlank, drittes bis sechstes Glied drei bis viermal so lang als breit, siebentes keulig, kürzer als das sechste, vom achten ab wieder mehr zylindrisch, das elfte lang-konisch, Behaarung äusserst zart, schneeweiss, fast so lang wie die Glieder breit. Prothorax etwa so breit wie in der Mitte hoch. Elytren mit vier Rippen, Behaarung kurz.

Länge, 5.5 Millimeter; Breite (hum.), 1.5, circa.

MINDANAO, Provinz Surigao, Surigao (*Baker*), 1 Mann. Typus in meinem Besitz.

Libnetis deductus sp. nov.

Hell lehmgelb, Prothorax in der Mitte, Fühler und Abdomen hellbräunlich, glanzend. Stirn so breit wie ein Augendurchmesser, breit, flach eingedrückt; drittes bis elftes Fühlerglied schlank, nach vorn an Länge und Breite abnehmend, ungezähnt, dicht behaart. Prothorax etwa so lang wie am Hinterrand breit, Vorderrand flach gebogen, Vorderecken stumpf, Seiten fast gerade, nach hinten etwas verbreitert, Hinterrand flach nach innen gebogen, Hinterecken spitz, kurz, Kiel in der starken Punktierung verborgen, Vertiefung am Hinterrand dreieckig, Punktierung grob, am Vorderrand breiter und stärker als an den anderen Rändern, Elytren mit vier undeutlichen Rippen, Behaarung dicht, kurz.

Länge, 5 Millimeter; Breite (hum.), 1.25, circa.

MINDANAO, Provinz Surigao, Surigao: Provinz Davao, Davao (*Baker*): Provinz Agusan, Cabadbaran (*Weber*). BASILAN (*Baker*); 2 Männer, 1 Weib. Typen in meinem Besitz.

Libnetis debilis sp. nov.

Schwarz, basale Flügelhälfte und die Basis aller Schenkel schmutzig-gelb. Stirn breiter als ein Augendurchmesser, tief, breit eingekerbt, schmal punktiert und unbehaart. Fühler in beiden Geschlechtern ungezähnt, dicht behaart. Prothorax trapezoid, Kiel am Vorderrand scharf, Areole am Hinterrand kurz, schmal, sonst normal. Elytren mit vier deutlichen Rippen, Behaarung dicht.

Länge, 4 bis 5 Millimeter; Breite (hum.), 1 bis 1.25.

LUZON, Provinz Laguna, Paete (*Böttcher*). MINDANAO, Provinz Surigao, Surigao (*Baker*): Provinz Lanao, Momungan (*Böttcher*). SAMAR (*Baker*); 27 Exemplare gesehen. Typen in meinem Besitz.

Die Art variiert beträchtlich. Ausser den üblichen sexuellen Differenzen finden sich Abänderungen in der Ausfärbung. Die basalen Fühlerglieder können gelb gefärbt sein, der Prothorax ist öfter an den Seiten heller, manchmal direkt gelb, in extremen Fällen kann die schwarzbraune Farbe ganz zurücktreten. Die Elytren sind meist bis zur Hälfte schwarz, der schwarze Farbenkomplex kann aber auch hinter der Mitte zurückbleiben. Die wollige Behaarung wechselt in der Stärke. Der Prothorax kann ziemlich vorgezogene Hinterecken haben, ist in der Gestalt überhaupt wenig einheitlich. Als ein sehr konstantes Merkmal hat sich die sichere Ausbildung der ersten Elytrenrippe erwiesen .(cf. das bei *gracillimus* gesagte).

Bestimmungstabelle der philippinischen Libnetis-Arten.

1. Einfarbig erdbraune bis braunschwarze Art.... **L. commendabilis sp. nov.**
Wenigstens die Elytren zum Teil gelblich........ 2.
2. Elytren mit drei Rippen (die erste fehlt)........ **L. gracillimus sp. nov.**
Elytren mit vier Rippen .... 3.
3. Prothorax mit stark vorgezogenen Hinterecken, die hellen Partieen der Elytren sind weissgelb........ **L. bardus sp. nov.**
Prothorax ohne vorgezogene Hinterecken, die hellen Farbenpartieen lehmgelb oder noch dunkler........ 4.
4. Prothorax erheblich breiter als lang, Fühler lang behaart. **L. coloratus sp. nov.**
Prothorax mehr quadratisch, Fühlerbehaarung normal, kürzer........ 5.
5. Penis breit klaffend, Ränder schmal (Tafel 3, Fig. 8). **L. defectus sp. nov.**
Penis schmal klaffend, Ränder breit .... 6.
6. Seiten des Prothorax nicht nach hinten erweitert, nicht parallel; Penis, Tafel 3, Fig. 10........ **L. deductus sp. nov.**
Seiten des Prothorax nach hinten erweitert; Penis, Tafel 3, Fig. 11. **L. debilis sp. nov.**

Genus **DILOPHOTES** Waterhouse

Dilophotes WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 75.

Auch diese Gattung muss als orientalisch angesehen werden. Sie ist habituell sehr einheitlich und von den zuweilen sehr ähnlichen *Libnetis*-Arten auf jeden Fall durch die Penisform getrennt. Bei *Dilophotes* scheint der Penis artlich vielgestaltig zu sein, bei *Libnetis* dagegen sehr einförmig, in beiden Geschlechtern aber total verschieden.

Von den Philippinen habe ich zwei Arten gesehen, von denen eine auch von Nordost Borneo bekannt geworden ist.

Dilophotes abnormis sp. nov.

Erdbraun bis schwärzlich, Prothorax, Elytren an der Basis in mehr oder weniger grossem Umfange, zuweilen die Schenkel im Basalteil, und das Prosternum orangegelb. Kopf schmal aber deutlich gefurcht. Fühlerglieder gezähnt, beim Mann länger als breit, beim Weib mehr quadratisch, Seitenränder stark erhöht, Hinterrand in der Mitte vorgewölbt, Kiel in der vorderen Hälfte scharf. Elytren mit sehr deutlichen Rippen, von denen auch die erste bis fast zum Hinterrand reicht. Penis, Tafel 3, Fig. 13.

LUZON, Mount Banahao (*Baker, Böttcher*): Provinz Bataan, Mount Limay (*Baker*): Subprovinz Benguet, Baguio (*Baker*): Subprovinz Amburayan, Butac, 1,400 Meter (*Böttcher*). MINDANAO, Provinz Surigao, Surigao: Provinz Lanao, Kolambugan (*Baker*); Momungan (*Böttcher*). SIBUYAN (*Baker*). NEGROS, Cuernos Gebirge (*Baker*); 42 Männer, 20 Weiber. Typen in meinem Besitz.

Die Variationsbreite ist sehr gross. In der Ausfärbung kommen enorme Differenzen vor. Die Elytren können soweit verdunkeln, dass nur noch ein undeutlicher, gelber Schimmer bleibt, Prothorax und Kopf können ganz schwarz werden, ebenso die Beine und das Prosternum, so dass das ganze Tier schwarz erscheint. Die Aufhellung kann andrerseits soweit vorschreiten, dass auf den Elytren nur der Hinterrand schwarz bleibt, die an sich schon hellen Organteile ganz hellorange werden. Die Ausfärbung ist aber trügerisch und keine Eigenschaft ähnliche Arten zu trennen. Dazu kommt als weiteres erschwerendes Moment der Umstand, dass auch die Fühler keineswegs einheitliche Gestalt haben. Die Differenzen sind so bedeutend dass die Männer alle auf den Begattungsapparat untersucht werden müssen, um eine sichere Arttrennung zu ermöglichen. Alle *Dilophotes* die nicht auf den Begattungsapparat festgelegt sind, sind in ihrer artlichen Sicherheit wertlos. Die Männer sind meist einfarbig schwarzbraun, die Weiber haben gelben Prothorax, Schildchen, und Elytrenbasis. Es ist die einzige Art, bei der ich sichere sexuelle Dimorphie beobachten konnte.

Ich hatte zweiundsechszig Individuen von den verschiedensten Fundorten zur Verfügung, die meisten Männer sind auf den Begattungsapparat untersucht und gegenübergestellt. In diesem Organ waren keine Abweichungen festzustellen.

Dilophotes comes sp. nov.

Mit *abnormis* sehr nahe verwandt, in manchen Stücken nur durch den Begattungsapparat trennbar. Am besten noch durch die langen Fühlerglieder zu unterscheiden, die bei *abnormis* auch Neigung zur Verlängerung haben. Das sicherste Unterscheidungsmerkmal ist der Begattungsapparat, der von ganz anderer Gestalt ist.

Länge und Breite wie bei *abnormis*.

LUZON, Provinz Tayabas, Casiguran: Provinz Sorsogon, Mount Bulusan (*Böttcher*). MINDANAO, Provinz Surigao, Surigao: Provinz Zamboanga, Dapitan: Provinz Lanao, Kolambugan (*Baker*). BASILAN (*Baker*). NEGROS, Cuernos Gebirge (*Baker*). BORNEO, Sandakan (*Baker*); 70 Manner, 31 Weiber. Typen in meinem Besitz.

Die Variationsgrenzen sind leider auch hier recht gross, sowohl was Ausfärbung, Ausdehnung der einzelnen Farbenkomplexe, und Form der Fühlerglieder anlangt. Es ist darauf zu achten, dass die Skulptur der Fühlerglieder feiner als bei *abnormis* ist und dass die Glieder auch meist längere Gestalt haben. Grundsätzlich trennt aber nur der Begattungsapparat, der zur sicheren Arttrennung herangezogen werden muss.

Bestimmungstabelle der philippinischen Dilophotes-Arten.

Fühlerglieder kurz, gedrungen, Präputium zangenartig, nicht aufklappbar. **D. abnormis** sp. nov.
Fühlerglieder schlank, Präputium aufklappbar.................. **D. comes** sp. nov.

Genus **SCARELUS** Waterhouse

Scarelus WATERHOUSE, Trans. Ent. Soc. London (1878) 104.

Eine einzige philippinische Art dieser orientalischen Gattung.

Scarelus crudus sp. nov.

Mann.—Abdomen, Fühler, Schienen, und Tarsen braun, sonst lehmgelb. Fühler fast doppelt so lang wie das ganze Tier, nicht gezähnt, seitlich platt, dicht, kurz behaart. Kopf und Prothorax normal, dicht behaart. Elytren nur mit zwei deutlichen Rippen, die erste neben der Naht liegende so undeutlich dass sie nicht sichtbar ist, Gitterung querrechteckig, durch dichten Filz verdeckt, überall mit einzelnen, zerstreuten, aufrechtstehenden Haaren.

Länge, 5 bis 7 Millimeter (ohne Fühler); Breite (hum.), 1.25 bis 1.5.

LUZON, Provinz Tayabas, Malinao (*Baker*); Mount Banahao (*Baker*). MINDANAO, Provinz Surigao, Surigao (*Baker*): Provinz Lanao, Iligan (*Baker*). Holotypus in meinem Besitz.

Die Variationsbreite ist gering, von den wenigen bekannten Arten trennt die fehlende erste Rippe leicht und sicher.

Genus **LYROPAEUS** Waterhouse

Lyropaeus WATERHOUSE, Trans. Ent. Soc. London (1878) 105.

Orientalisch. Wenige Gattungen sind so scharf umgrenzt wie *Lyropaeus*. Von den Philippinen ist nur die nachstehende Art bekannt geworden.

Lyropaeus philippinensis sp. nov.

Mann.—Abdomen, an den Vorderbeinen Schienen und Tarsen, an den Mittelbeinen desgleichen, zum Teil auch die Schenkel, die Hinterbeine ganz, Kopf und Fühler erdbraun, sonst hell chromgelb. Prothorax und Elytren sind in der Ausfärbung sehr variabel. Der Prothorax kann am Vorderrand verdunkelt sein, die graubraune Farbe kann sich über das Schildchen bis auf die Elytrenbasis erstrecken, selbst die Elytren können mehr oder weniger schwarz werden. Erstes Fühlerglied kurz, becherförmig, zweites sehr kurz, drittes 1.5 mal so lang wie das vierte, viertes bis elftes etwa gleichlang. Elytren mit drei Rippen, die erste deutlich, die zweite schwach, die dritte nur auf der Mitte noch sehr schwach, alle drei gegen den Hinterrand gleichmässig verkürzt. Penis, Tafel 3, Fig. 19.

Länge, 5.5 bis 6.5 Millimeter; Breite (hum.), 1.5.

MINDANAO, Provinz Surigao, Surigao: Provinz Lanao, Iligan (*Baker*); 4 Männer. Holotypus in meinem Besitz.

Die Variation ist also ziemlich gross und mahnt bei Festlegung der Art zur grössten Vorsicht. Die Differenzen in der artlichen Gestalt des Penis scheinen aber ziemlich bedeutend zu sein und es wären alle Arten darauf hin zu untersuchen.

Genus **METRIORRHYNCHUS** Guérin Méneville

Metriorrhynchus GUÉRIN MÉNÉVILLE, Voy. Coquille (1838) Entom. 72

Diese weitverbreitete Gattung ist auch auf den Philippinen mit vier Arten vertreten, Habituell besteht grosse Einförmigkeit, in der Gestalt des Begattungsorganes dagegen ist weniger Einheitlichkeit zu beobachten. Es hat sich gezeigt, dass man für die Gattung einen Grundtypus annehmen kann, der dadurch gekennzeichnet ist, dass der Penis asymmetrisch ist und in der Asymmetrie die bizarrsten Formen entwickelt hat. Die philippinischen Arten gehören alle hierher. Eine andere Gruppe hat symmetrischen Penis von ganz anderer Grundgestalt. Die Verwandtschaftlichen Verhältnisse der beiden Gruppen sind noch zu klären.

Metriorrhynchus philippinensis Waterhouse.

Metriorrhynchus philippinensis WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 52, t. 13, f. 4.

Luzon, Provinz Laguna, Mount Maquiling; Mount Banahao; Los Baños (*Baker*); Santa Maria (*Rivera*): Provinz Bataan, Lamao (*Cuzner*); Limay (*Baker, Böttcher*): Provinz Bulacan, Sibul Springs (*J. Sanchez*): Provinz Nueva Vizcaya, Balete Pass (*Schultze*); Imugan, 4,000 Fuss (*Böttcher*): Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*): Provinz Tayabas, Casiguran (*Böttcher*): Subprovinz Benguet, Trinidad, 4,000 Fuss (*Böttcher*). POLILLO (*Böttcher*). SAMAR (*Baker*). SIBUYAN (*Baker*). BOHOL (*M. Ramos*). MASBATE (*Böttcher*). DINAGAT (*Böttcher*). NEGROS, Provinz Oriental Negros, Cuernos Gebirge (*Baker*): Provinz Occidental Negros, Fabrica (*Schultze*). SIQUIJOR (*Schultze*). PANAY (*Baker*). LEYTE, Burauen (*Böttcher*). BILIRAN (*Böttcher*). MINDANAO, Provinz Agusan, Butuan (*Baker*); Cabadbaran (*Weber*); Agusan River (*Schultze*): Provinz Surigao, Surigao (*Baker*): Provinz Lanao, Iligan (*Baker*); Momungan (*Böttcher*); Kolambugan (*Baker*): Provinz Davao, Davao (*Baker*); Monkayo (*Weber*): Provinz Zamboanga, Zamboanga (*Baker*); Pòrt Banga (*Böttcher*). BASILAN (*Baker*). PALAWAN, Puerto Princesa (*Baker*).

Ich sah etwa 4,000 Individuen. Es ist die verbreitetste und gemeinste Art des ganzen Archipels. Die Farbenvariationen sind sehr gross, sonst ist die Variation gering. Lokalrassen waren nicht nachzuweisen.

Metriorrhynchus croceus sp. nov.

Unterseite des Körpers und die Beine blaumetallisch, glänzend, Fühler und Kopf schwarz, hinteres Drittel der Elytren schwarzbraun, sonst rotorange, matt. Fühler schlank, die Glieder gezähnt, nicht pectinat, grob punktiert, ohne Behaarung. Prothorax mit deutlichen Areolen, etwas länger als breit, Vorderrand gerundet, Vorderecken stumpf, Seiten mehr oder weniger gerade, Hinterrand geschwungen, Hinterecken wenig vortretend, Punktierung wenig scharf. Elytren ohne besondere Merkmale.

Länge, 9 Millimeter; Breite (hum.), 2.2.

MINDANAO, Provinz Agusan, Butuan: Provinz Lanao, Kolambugan (*Baker*); Momungan (*Böttcher*): Provinz Surigao, Surigao (*Baker, Böttcher*): Provinz Zamboanga, Dapitan (*Baker*); 20 Männer und Weiber. Typen in meinem Besitz.

Die Art ist von *forcipatus* durch die zinnoberrote Farbe und allgemein geringere Grösse leicht trennbar. Der Penis ist in beiden Arten sehr verschieden, obwohl er durchaus dem *Metriorrhynchus*-Typ angehört. Die Variationsbreite ist nur gering.

Metriorrhynchus forcipatus sp. nov.

Von der Statur des *philippinensis* Waterhouse. Abdomen, Beine mit Ausnahme der Schenkelwurzeln, Kopf und Fühler schwarzblau, Elytren im hinteren Drittel braunschwarz, Unterseite mehr oder weniger glänzend, sonst matt. Fühler, Prothorax und Elytren gleich *philippinensis.*

Länge, 14 Millimeter; Breite (hum.), 3.

LUZON, Subprovinz Benguet, Baguio (*Baker*), 1 Mann. Holotypus in meinem Besitz.

Diese Art ist von *croceus* und *böttcheri* durch den Penis unterschieden; von beiden Arten ferner durch die hellgelbe Färbung des Prothorax und des nicht schwarzen Elytrenteiles, der bei den anderen beiden Arten ziegelrot bis orangerot ist; von *böttcheri* ferner durch starke Erweiterung der hellen Elytrenpartie; die schwarze Spitzenpartie geht kaum über das Spitzendrittel hinaus.

Metriorrhynchus böttcheri sp. nov.

Abdomen, Brust, Beine, Kopf, und Fühler blauschwarz, Prothorax, Schildchen, und der basale Teil der Elytren rotgelb bis orangerot, der Spitzenteil schwarz. Drittes bis elftes Fühlerglied etwa doppelt so lang wie breit, vom fünften ab mit schwacher Zähnung. Prothorax länger als breit, Vorderrand rund, Vorderecken stumpf, Seiten in der Mitte nach innen gebuchtet, Hinterecken wenig vorgezogen, Hinterrand in der Mitte ausgebuchtet, Areolen schmal, kräftig, discoidale Areole am Hinterrand offen, Punktierung schwach. Elytren mit normalen Rippen, Gitterung dicht, querrechteckig, Behaarung in der hellen Partie dicht, seidig, in der schwarzen nur schwach.

Länge, 14 bis 20 Millimeter; Breite (hum), 3 bis 5.

LUZON, Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*), 13 Männer, 11 Weiber. Typen in meinem Besitz.

Dem erfolgreichen Sammler des grossen Philippinen-Materials gewidmet.

Metriorrhynchus böttcheri ist nur mit *forcipatus* zu vergleichen. Beide Arten haben querrechteckige Elytrengitterung. Der Penis ist in beiden Arten total verschieden. Die äusseren Merkmale sind folgende: Die hellen Farbentöne sind bei *forcipatus* hell lehmgelb, bei *böttcheri* orangerot bis ziegelrot. Der schwarze Spitzenteil erreicht bei der ersteren Art nicht die Mitte, bei letzterer geht er weit darüber hinaus und lässt zuweilen nur das basale Viertel frei.

Bestimmungstabelle der philippinischen Metriorrhynchus-Arten.

1. Elytren einfarbig orangerot bis lehmgelb.... **M. philippinensis** Waterhouse.
Spitzenteil der Elytren immer in mehr oder weniger grossem Umfange schwarz .... 2.

2. Grosse Art; nur das basale Drittel orange; Penis, Tafel 3, Fig. 25 und 26........ **M. böttcheri** sp. nov.
Kleinere Arten; die schwarze Farbe erreicht die Mitte nur selten.... 3.
3. Die hellen Farbenpartieen dunkel-ziegelrot; Penis, Tafel 3, Fig. 22 und 23........ **M. croceus** sp. nov.
Die hellen Farbenpartieen lehmgelb; Penis, Tafel 3, Fig. 24. **M. forcipatus** sp. nov.

Genus CLADOPHORUS Guérin Méneville

Cladophorus GUÉRIN MÉNÉVILLE, Voy. Coquille (1838) Entom. 72.

Die Gattung dürfte in der Hauptsache papuanisch und australisch sein. Die Verbreitung erstreckt sich westlich bis ins orientalische Gebiet, von den Philippinen ist nur eine Art bekannt geworden. Die Stellung zu *Metriorrhynchus* und *Cautires* ist noch nicht geklärt. Es wird erst nach Aufarbeitung der Gattungen möglich sein, deren Grenzen fester zu umschreiben. Der Penis ist von recht einheitlicher Gestalt und wird zur Abgrenzung ein wichtiges Merkmal bilden.

Cladophorus fragilis sp. nov.

Abdomen, Beine mit Ausnahme der Schenkelbasis und die Fühler erdbraun, sonst lehmgelb. Fühler des Mannes kurz gekämmt, Lamellen kaum länger als das Glied selbst, Fühlerglieder des Weibes kräftig gezähnt. Prothorax etwa quadratisch, Vorderrand gerundet, Vorderecken stumpf, Seiten und Hinterrand flach nach innen geschwungen, Hinterecken kurz vorgezogen, Areolen tief, scharf getrennt, discoidale Areole schmal, die in den Vorderrand verlaufenden zuweilen dicht am Rande obsolet, Punktierung ausgedehnt, grob, tief, Behaarung schwach. Schildchen halbelliptisch eingebuchtet. Elytren ohne besondere Merkmale, Gitterung quadratisch; Behaarung kurz. Penis, Tafel 3, Fig. 28.

Länge, 9 bis 10.5 Millimeter; Breite (hum.), 2.5.

MINDANAO, Provinz Lanao, Iligan (*Baker*); Kolambugan (*Baker, Böttcher*): Provinz Zamboanga, Dapitan (*Baker*): Provinz Surigao, Surigao (*Baker, Böttcher*): Provinz Bukidnon (*Baker*): Provinz Agusan, Cabadbaran (*Weber*): Provinz Zamboanga, Zamboanga (*Baker*); Port Banga (*Böttcher*). BASILAN (*Baker*). SAMAR, Catbalogan (*Baker, Böttcher*). NEGROS, Cuernos Gebirge (*Baker*); 25 Männer, 20 Weiber. Typen in meinem Besitz.

Die Variationsbreite ist gering und erstreckt sich auf mehr oder weniger starke Verdunkelung der Schenkel, meist sind sie hellgelb. Es ist der erste *Cladophorus* den ich von den Philippinen sehe; es besteht oberflächliche Aehnlichkeit mit *Metriorrhynchus philippinensis.*

Genus **CAUTIRES** Waterhouse

Cautires WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 36.

Cautires gehört zu den schwierigsten Gattungen der ganzen Familie. Infolge ihres intermediären Charakters hat sie nahe Verbindung sowohl mit *Metriorrhynchus* wie mit *Cladophorus.* Die nähere Verwandtschaft besteht ohne Zweifel mit letzterer Gattung schon durch die pectinaten Fühler des Mannes. Das männliche Begattungsorgan ist auch *Cladophorus* sehr ähnlich und hat an *Metriorrhynchus* keine Anklänge. Die Gattung ist keineswegs so beschränkt zu fassen, wie das Waterhouse getan hat. Der Prothorax ist von recht wechselnder Gestalt, das trifft auch für die Ausbildung der Areolen zu. Ich habe allgemein diejenigen Arten zu *Cautires* gezogen, deren Areolen nicht alle voll entwickelt waren, wo die Fühler deutlich pectinat und der Penis nicht *Cladophorus*-Typ hatte.

Unter dem mir vorliegenden Material fanden sich zwei Arten vor, die ich zu *Cautires* gestellt habe. Die Gattung ist nach der heutigen Aufstellung weit verbreitet; ob alles seine Richtigkeit hat, könnte nur monographische Bearbeitung erweisen.

Cautires coronarius sp. nov.

Mann.—Schwarz, Prosternum, Hüften, Coxen, die basale Hälfte aller Schenkel, Prothorax, Schildchen und die basale Hälfte der Elytren rotgelb. Kopf zwischen den Fühlern mit einer schmalen Platte, die durch eine Längsfurche vertieft ist. Fühler sehr kurz behaart. Prothorax und Elytren ohne besondere Merkmale. Penis, Tafel 3, Fig. 29.

Länge, 9 bis 14 Millimeter; Breite (hum.), 2.2.

LUZON, Provinz Bataan, Limay (*R. F. Alvarez*): Subprovinz Benguet (*McGregor*); Baguio (*Baker*). NEGROS, Cuernos Gebirge (*Baker*). Holotypus in meinem Besitz.

Mit keiner anderen Art des orientalischen Gebietes zu verwechseln. Die Ausdehnung der einzelnen Farbenpartieen auf den Elytren kann wechseln, in der Regel bleibt schwarz hinter der Mitte zurück, kann aber auch die Mitte überschreiten.

Cautires exploratus sp. nov.

Abdomen, Beine mit Ausnahme der Schenkelbasis, Kopf mit Ausnahme der Mundteile und Fühler schwarz, sonst lehmgelb, mässig glänzend. Prothorax trapezoid, am Hinterrand so lang wie in der Mitte hoch, Vorderrand steil, schräg abfallend, Vorderecken rund, Seiten flach nach innen geschwungen, gegen den Hinterrand erweitert, der Hinterrand kräftig nach innen geschwungen, Hinterecken nicht vorgezogen, alle Areolen schwach entwickelt, die seitlichen ganz fehlend, Punktierung mit Ausnahme des Hinterrandes ansehnlich, Behaarung kurz, dicht. Schildchen dreieckig eingekerbt. Elytren normal.

Länge, 11 Millimeter; Breite (hum.), 2.5.

LUZON, Subprovinz Bontoc, Mount Polis, 2,400 Fuss (*Böttcher*) : Subprovinz Kalinga, Balbalasan, 5,000 Fuss (*Böttcher*) : Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Baker, Böttcher*). MINDANAO, Provinz Surigao, Surigao (*Baker, Böttcher*). SAMAR (*Baker*) ; 10 Männer, 3 Weiber. Typen in meinem Besitz.

Von *coronarius*, der einzigen Art die zum Vergleich in Frage kommt, durch die einfarbigen Elytren und den anders geformten Prothorax bestimmt verschieden. Der Prothorax ist in seiner Gestalt nicht einheitlich und wird zuweilen breiter.

Bestimmungstabelle der philippinischen Cautires-Arten.

Elytren ganz lehmgelb	**C. exploratus** sp. nov.
Elytren in der Spitzenhälfte schwarzbraun	**C. coronarius** sp. nov.

Genus **BULENIDES** Waterhouse

Bulenides WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 34.

Im orientalischen Gebiet weit verbreitet und durch die Form des Prothorax, der Fühler, und Elytren scharf umgrenzt. Auf den Philippinen sind vier Arten aufgefunden worden.

Bulenides aterrimus sp. nov.

Einfarbig schwarz. Fühler pectinat, Lamellen kaum länger als der Stiel, zart punktiert und schwach behaart. Prothorax länger als breit, Kiel undeutlich, nur am Vorderrand schärfer, Punktierung zart und nur an den Rändern vorhanden.

Länge, 5 bis 6 Millimeter; Breite (hum.), 1.5, circa.

LUZON, Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*). MINDANAO, Provinz Surigao, Surigao: Provinz Agusan, Butuan (*Baker*). NEGROS, Cuernos Gebirge (*Baker*) ; 5 Männer; 2 Weiber. Typen in meinem Besitz.

Die Art sieht *adumbratus* ähnlich, sie ist auch ohne Zweifel damit verwandt. Das beweist die grosse Aehnlichkeit des Penis. Der Prothorax hat aber eine ganz andere Gestalt und erinnert durch seine lange Form an *Leptotrichalus.* Ich fand keinerlei Uebergänge, obgleich ich von *adumbratus* eine ganze Serie zur Hand hatte. Es handelt sich ohne Frage um eine gute Art.

Bulenides adumbratus sp. nov.

Schwarz, nur der Prothorax, das Schildchen und zuweilen die Elytren unmittelbar an der Basis orangegelb, kein Glanz. Fühler des Mannes mit Lamellen die länger als der Stiel sind, des Weibes breit, tief gezähnt, die einzelnen Glieder dicht stehend. Prothorax trapezoid, Hinterecken spitz, Areole schmal, kaum über die basale Hälfte hinausgehend, der davor liegende Kiel schmal und stark erhöht, Punktierung in der gekielten Partie und an den Seiten kräftig, Behaarung dicht und kurz. Schildchen hinten ausgerundet, dicht behaart. Elytren normal, die Sekundärrippen kräftig entwickelt, Gitterung gleichmässig, meist viereckig, Behaarung kurz, dicht. Beine und Abdomen normal, dicht behaart.

Länge, 8 bis 10 Millimeter; Breite (hum.), 2 bis 2.75.

LUZON, Mount Banahao (*Baker, Böttcher*) : Provinz Laguna, Mount Maquiling (*Baker*) ; Los Baños (*Böttcher*) : Provinz Bataan (*Alvarez*) ; Limay (*Baker*). MINDANAO, Provinz Surigao, Surigao: Provinz Lanao, Momungan (*Böttcher*) : Provinz Agusan, Butuan (*Baker*). SIBUYAN (*Baker*). NEGROS, Cuernos Gebirge (*Baker*) ; Canlaon Volkan (*Banks*) ; 6 Männer, 10 Weiber. Typen in meinem Besitz.

Die Variationsbreite ist nicht gering, der Prothorax kann aber soweit verdunkeln, dass nur die Seitenränder gelb bleiben, auch das Schildchen kann schwarz sein. Die Sicherheit der Art ist bei der starken Variation durch Penisautopsie zu sichern.

Bulenides adventicius sp. nov.

Prothorax, Schildchen und die Elytren in den vorderen zwei Dritteln ziegelrot, sonst schwarz, Unterseite des Körpers glänzend, sonst matt. Fühler mit dichtgedrängten, tiefgezähnten Gliedern, in der Gestalt von *adumbratus.* Prothorax etwa quadratisch, Vorderrand schräg, Seiten nach hinten zu mässig erweitert, Hinterrand schwach geschwungen, Hinterecken spitz, Areolen sehr schmal, der davorliegende Kiel fast so lang wie die Areole, schmal, erhaben. Punktierung undeutlich. Elytren normal, Sekundärripen an der Basis kräftiger als im Spitzenteil. Beine normal. Unterseite des Körpers nur sehr wenig behaart.

Länge, 7 bis 10 Millimeter; Breite (hum.), 2 bis 3.

MINDANAO, Provinz Surigao, Surigao (*Baker, Böttcher*): Provinz Lanao, Kolambugan; Iligan (*Baker*); Momungan (*Böttcher*). PANAON (*Böttcher*); 24 Männer, 18 Weiber.

Die Art variiert nicht unbeträchtlich. Der Prothorax ist in beiden Geschlechtern von ganz verschiedener Gestalt, beim Mann schlank, trapezoid, beim Weib breit, quadratisch oder noch breiter. Die rote Farbe ist meist ziegelrot, kann aber in allen Abstufungen bis schmutzig-lehmgelb auftreten. Vielleicht sind es Individuen die bei der Präparation gelitten haben, es hat wenigstens den Anschein. Prothorax und Schildchen haben Neigung zur Verdunkelung. Das Schildchen kann ganz dunkel werden, der Prothorax wenigstens zum Teil. Das ist auch bei Individuen mit auffallend leuchtend roten Farben zu beobachten. Von *parvulus* trennt die rote Farbe der Elytren, der ganz anders gebaute Penis und die nicht steile und nicht eingedrückte Stirn.

Bulenides parvulus sp. nov.

Mann.—Erdbraun, Prothorax, und Elytren in der vorderen Hälfte lehmgelb, matt. Stirn keilförmig, über den Fühlern tief, gross, fast kreisförmig eingedrückt, nicht vorgewölbt, sondern steil abfallend, überall zart punktiert und behaart. Fühler, Prothorax, und Elytren gleich *aterrimus*.

Länge, 6 Millimeter; Breite (hum.), 2, circa.

MINDANAO, Provinz Agusan, Cabadbaran (*Weber*). Holotypus in der Sammlung des Bureau of Science zu Manila.

In der Ausfärbung besteht Aehnlichkeit mit *adventicius*, die hellen Farbenpartieen sind aber rot und nicht lehmgelb und der Prothorax ist von anderer Gestalt. In der Tat bestehen auch keine näheren Beziehungen dieser beiden Arten; die Penisformen sind ganz verschieden. Viel näher scheint mir *aterrimus* zu stehen, mit dem *parvulus* habituell ganz übereinstimmt. Ferner haben beide Arten einen sehr ähnlichen Penis. Was die Arten ausser der Farbe, die nur ganz sekundären Wert hat, trennt, ist die Gestalt des Kopfes. Bei *aterrimus* ist die Stirn breit, gewölbt, eine Vertiefung fehlt, die Augen stehen ganz seitlich. Bei *parvulus* sind die Augen gross, die Stirn daher schmal, senkrecht und mit einer grossen, kreisförmigen Vertiefung versehen. Die Kopffiguren sind also ganz verschieden.

Bestimmungstabelle der philippinischen Bulenides-Arten.

1. Einfarbig schwarz .... **B. aterrimus** sp. nov.
   Wenigstens der Prothorax gelb oder rot .... 2.
2. Elytren ganz schwarz, Prothorax orangerot .... **B. adumbratus** sp. nov.
   Elytren in der basalen Hälfte rot oder gelb .... 3.

3. Die hellen Partieen auf den Elytren sind ziegelrot oder schmutziglehmgelb, Stirn nicht kreisförmig eingedrückt.. **B. adventicius** sp. nov.
Die hellen Partieen sind hell-lehmgelb, Stirn kreisförmig eingedrückt.
B. parvulus sp. nov.

Genus **XYLOBANUS** Waterhouse

Xylobanus WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 38.

Die Gattung ist von Australien über das ganze papuanische, orientalische, aethiopische, und madagassische Gebiet verbreitet. Wohl keine Gattung, mag sie noch so gross sein, hat ein so gewaltiges Conglomerat von Formen in sich vereinigt. *Xylobanus* ist ein klassischer Beweis für die Schwierigkeiten die sich einer sicheren Umgrenzung der Lycidengenera entgegenstellen. Was allen Arten gemeinsam ist, das ist das Fehlen der Sekundärrippen auf den Elytren. Dass dieses Merkmal nur ein ganz unsicheres sein und nur den Wert eines systematischen Hilfsmittels haben kann, ist keine Frage. Es genügt darauf aufmerksam zu machen, dass in Papua Arten vorkommen, die im Basal- und Spitzenteil noch Sekundärrippen besitzen. Ich habe diese Arten in die Gattung *Procautires* zusammengefasst. Es ist aber nur eine Klassifizierung aus Not, um möglichst kleine, fast umschriebene Formenkreise zu gewinnen. Im Penisbau findet sich ebensowenig Einheitlichkeit wie in den anderen Organen. Ich habe daher auch alles was keine Sekundärrippen besitzt in die Gattung gebracht.

Bisher war von den Philippinen kein *Xylobanus* bekannt, nachstehend sind dreiundzwanzig beschrieben; der Artbestand ist also ansehnlich und dürfte sich noch vergrössern.

Xylobanus blandus sp. nov.

Schwarzbraun, nur die Seitenränder des Prothorax und die Basis der Vorderschenkel braungelb, Glanz mässig, überall dicht, hell, kurz behaart. Fühlerglieder gedrungen, dicht aufeinanderstehend, kräftig gezähnt. Prothorax etwas länger als breit, mit sieben Areolen von scharfer Rippung, die vorderen Areolen dicht punktiert, die hinteren ohne Punktierung. Rippen und Gitterung in gleicher Höhe liegend, Gitterung quadratisch. Penis, Tafel 3, Fig. 41.

Länge, 6 Millimeter; Breite (hum.), 1.7.

LUZON, Mount Banahao (*Baker, Böttcher*): Provinz Laguna, Mount Maquiling (*Baker*). MINDANAO, Provinz Surigao, Surigao (*Baker*); 14 Männer und Weiber. Typen in meinem Besitz.

Kommt auch mit ganz schwarzem Prothorax vor, durch Penisautopsie sichergestellt. Die Gestalt der Fühlerglieder ist bei der Differentialdiagnose wichtiger als die Farbe.

Xylobanus benignus sp. nov.

Einfarbig schwarz, Fühler und Beine zuweilen dunkelbraun, meist ansehnlich glänzend, selten matter; Elytren dicht behaart. Kopf spiegelglatt, über den Augen mit Quergruben die aber auch gänzlich fehlen können; Mandibeln rotbraun, Taster gelblich, Fühler gezähnt, vom vierten ab länger als breit, nach vorn an Breite abnehmend. Prothorax mit sieben Areolen, etwa quadratisch, Vorderrand dachförming, Seitenrand schwach nach innen gebogen, Hinterrand flach nach innen geschwungen, Areolen scharfkantig. Rippen und die quadratische Gitterung auf den Elytren in gleicher Höhe liegend. Beine und Abdomen normal.

Länge, 7 bis 8 Millimeter; Breite (hum.), 2, circa.

MINDANAO, Provinz Surigao, Surigao: Provinz Agusan, Butuan (*Baker*). SIBUYAN (*Baker*); zahlreiche Männer und Weiber. Typen in meinem Besitz.

Die Variationsbreite ist nur gering, sie erstreckt sich auf die mehr oder weniger tiefe Ausfärbung der Elytren und der beuligen Eindrücke über den Fühlern auf dem Kopfe. Die Identität der variabelen Stücke ist durch Penisautopsie gesichert.

Xylobanus lanatus sp. nov.

Schwarz, am ganzen Körper dicht und lang behaart. Drittes bis zehntes Fühlerglied pectinat, Lamellen länger als das Glied. Prothorax in der Mitte so hoch wie am Hinterrand breit, mit fünf deutlichen Areolen, die seitlichen obsolet und nur ganz tiefliegend angedeutet, Vorderrand rundlich-dachförmig, Vorderecken stumpf aber deutlich, Seiten nach innen gebogen, gegen den Hinterrand nach aussen erweitert, Hinterecken stumpflich vorgezogen, Hinterrand in der Mitte vorgebuchtet, Seitenränder stark aufgebogen, Punktierung unter der Behaarung verborgen. Elytren starkrippig, Gitterung tiefliegend, querrechteckig. Penis, Tafel 3, Fig. 48.

Länge, 6 Millimeter; Breite (hum.), 2, circa.

MINDORO, Calapan (*Böttcher*), 1 Mann. Holotypus in Museum Natura Artis Magistra zu Amsterdam.

Von der folgenden Art durch die wollige Behaarung, durch andere Areolenbildung des Prothorax, und ganz andere Rippenbildung und Gitterung der Elytren unterschieden.

Xylobanus nitidus sp. nov.

Einfarbig schwarz, ohne wollige Behaarung, glänzend. Fühler wie bei *benignus*. Prothorax mit fünf Areolen, nur der Stiel der discoidalen erreicht den Vorderrand, die daneben liegenden in der tiefen Punktierung verborgen, Gestalt ähnlich *lanatus*, Punktierung tief und kräftig. Schildchen tief, halbelliptisch eingebuchtet. Auf den Elytren liegen die Rippen kaum höher als die Gitterung, letztere vorherrschend quadratisch, flach.

Länge, 7 Millimeter; Breite (hum.), 2.2, circa.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*), 1 Weib. Allotypus im Museum Natura Artis Magistra zu Amsterdam.

Es lag mir leider kein Mann vor. Trotzdem glaube ich, die Art unbedenklich festlegen zu können weil sie nur mit *lanatus* zu vergleichen ist und die Unterschiede zwischen den Arten so gross sind, dass keine Verwechslung zu befürchten ist. Die Verwandtschaft mit *benignus* ist wahrscheinlich grösser als mit *lanatus*.

Xylobanus consimilis sp. nov.

Braunschwarz, Prothorax, Schildchen, und Elytren hellorange. Fühler des Mannes lang pectinat, die Lamellen wenigstens viermal so lang wie das Glied selbst, des Weibes tief gezähnt, Behaarung beim Mann lang, einzeln, beim Weib kurz, dicht. Prothorax gleich *consentaneus*. Elytren mit stark erhabenen Rippen, Gitterung querrechteckig, zum Teil schmalrechteckig, Behaarung sehr kurz, dicht, infolge der dichten Behaarung stark glänzend. Penis zart, wenig pigmentiert, Tafel 3, Fig. 51.

Länge, 4.5 bis 7 Millimeter; Breite (hum.), 1.25 bis 1.5.

MINDANAO, Provinz Lanao, Iligan (*Baker*); Momungan (*Böttcher*): Provinz Surigao, Surigao (*Baker*): Provinz Davao, Davao (*Baker*): Provinz Zamboanga, Port Banga (*Böttcher*); 2 Männer, 2 Weiber. Typen in meinem Besitz.

Habituell besteht Anlehnung an *consobrinus*, die Lamellen der männlichen Fühler sind aber viel schmäler, der Penis von ganz anderer Gestalt und die Elytren sind dicht behaart; bei *consobrinus* dagegen ist die Behaarung kaum vorhanden und verdeckt den Grund nicht. Alle anderen Arten, die oberseits einfarbig orange sind, haben keine pectinaten Fühler.

Xylobanus consobrinus sp. nov.

Abdomen, Beine, und Fühler erdbraun, sonst hell lehmgelb, matt. Kopf mit breit und tief eingesenkter Stirn, kurz behaart.

Fühler des Mannes mit langen Lamellen, des Weibes tief gezähnt. Prothorax mehr oder weniger quadratisch, mit sieben sehr scharf ausgebildeten Areolen, Vorderrand gerundet, seitlich stumpfeckig, Seiten etwa in der Mitte, nach innen gebogen, Hinterrand mässig gebogen, Hinterecken stumpf. Punktierung nur im Vorderfeld und nur sehr undeutlich, überall kurz und dicht behaart. Elytren mit erhöhten, scharf abgesetzten Rippen, Gitterung etwas niedriger, quadratisch oder rechteckig, niemals schmal-rechteckig, Grundfläche glatt, matt, Behaarung auf den Rippen und der Gitterung kurz.

Länge, 8 bis 8.5 Millimeter; Breite (hum.), 2, circa.

MINDANAO, Provinz Surigao, Surigao (*Baker*). SAMAR (*Baker*); 6 Männer, 2 Weiber. Typen in meinem Besitz.

Es besteht grosse Aehnlichkeit mit *caelestis*, von der die Fühler leicht trennen, bei *caelestis* hat der Mann keine pectinaten Fühler. Das Begattungsorgan ist in beiden Arten ganz verschieden. Im weiblichen Geschlecht trennen sich die Arten am besten durch die Form des Prothorax, der bei *caelestis* an den Hinterecken spitz vorgezogen ist, bei *consobrinus* nicht.

Xylobanus pubens sp. nov.

Abdomen schwarzbraun, Brust gelb, Beine mit Ausnahme der hellen Schenkelbasis dunkel, Kopf und Fühler schwarzbraun, Prothorax, Schildchen, und Elytren lehmgelb, matt. Letztes Glied der Mandibulartaster gross, blattartig. Fühler schlank, drittes bis elftes Glied wenigstens doppelt so lang wie breit, seitlich parallel, ungezähnt. Prothorax quadratisch, Vorderrand dachförmig, Vorderecken scharfkantig, Seiten flach nach innen geschwungen, gegen den Hinterrand etwas vorgezogen, Hinterecken spitz, Hinterrand nach innen geschwungen, sieben Areolen, von denen die seitlichen etwas schwächer als die übrigen sind, Ränder stark aufgebogen, Punktierung durch Behaarung verdeckt. Schildchen flach eingekerbt. Elytren mit sehr grosser Gitterung von quadratischer bis querrechteckiger Form, Rippen etwas höher als die Gitterung liegend, beide vom Grunde scharfkantig abgehoben.

Länge, 11 bis 12 Millimeter; Breite (hum.), 3.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*), 1 Mann, Weib. Holotypus in meinem Besitz; Allotypus im Museum Natura Artis Magistra zu Amsterdam.

Xylobanus caelestis sp. nov.

Mit *brevis* nahe verwandt, Elytren ohne jede Schwarzfärbung, höchstens der Hinterrand selbst, nicht die Fläche, schwach angedunkelt, Elytren an der Basis meist gelb. Fühlerglieder länger als breit, stumpf gezähnt. Prothorax von sehr wechselnder Gestalt, mit fünf, zuweilen undeutlichen oder unvollständig verbundenen Areolen, Vorderrand rundlich oder etwas kantig, Seiten fast gerade, gegen den Seitenrand nach aussen gerichtet. Gitterung der Elytren meist querrechteckig, zuweilen auch quadratisch. Penis, Tafel 4, Fig. 1.

Länge, 6 bis 9 Millimeter; Breite (hum.), 1.5 bis 2.

LUZON, Provinz Laguna, Los Baños (*Baker*): Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*). MINDANAO, Provinz Davao, Davao (*Baker*): Provinz Agusan, Butuan (*Baker*): Provinz Surigao, Surigao (*Baker*): Provinz Lanao, Kolambugan; Iligan (*Baker*); Momungan (*Böttcher*): Provinz Zamboanga, Zamboanga (*Baker*); Port Banga (*Böttcher*). BASILAN (*Baker*). SAMAR (*Baker*). LEYTE, Burauen (*Böttcher*). SAN MIGUEL (Provinz Samar) (*Böttcher*). PANAON (*Böttcher*); zahlreiche Männer und Weiber. Typen in meinem Besitz.

Obwohl habituell gegen *brevis* kein Unterschied besteht, ist die Trennung der Arten durch das Fehlen der schwarzen Hinterrandpartie auf den Elytren leicht.

Die Variationsbreite ist nur gering und betrifft in erster Linie die Elytrengitterung. Vorherrschend ist die Form querrechteckig, kann aber fast quadratisch, niemals aber länger als breit werden. Die Ausbildung der Thoraxareolen ist auch recht wechselnd und die Punktierung schwankt in ihrer Tiefe sehr, Ferner kommt eine Variation mit gelbem elften Fühlergliede vor.

Xylobanus barbarus sp. nov.

Kopf, Fühler, die Beine mit Ausnahme der Schenkelbasis, und das Abdomen braunschwarz bis schwarz, Prothorax, Schildchen, Elytren, und Brust bleichgelb bis hell-ockerfarbig. Fühler schwach gezähnt, dritter wenig länger als breit, vom vierten ab erheblich länger als breit (Mann), beim Weib von gleicher Gestalt. Kopf hochglänzend, mit feiner, seidenartiger Behaarung. Prothorax an der Basis so breit wie in der Mitte hoch, Vorderrand schwach gerundet, Seiten fast gerade, Hinterrand geschwungen, Aussenecken wenig vorstehend, mit fünf, zuweilen undeutlichen Areolen. Elytren mit scharfkantigen Rippen und gleicher Furchengitterung, Gitterung querrechteckig, Rippen und Gitterung kurz, borstig behaart. Penis kurz, löffelförmig, oberseits mit gewölbtem Präputium.

Länge, 7 bis 9 Millimeter; Breite (hum.), 2.

LUZON, Mount Banahao: Provinz Laguna, Mount Maquiling; Los Baños (*Baker*): Provinz Nueva Vizcaya, Imugan (*Baker*). SAMAR (*Baker*); 4 Männer, 4 Weiber. Typen im Dresdener Museum.

Die Art variiert in der Tiefe der braunschwarzen Körperteile, namentlich der Fühler und des Kopfes. Die Areolen auf dem Prothorax sind zuweilen sehr undeutlich. Penisuntersuchung ist bei ähnlichen Arten (*caelestis*) unbedingt nötig.

Xylobanus canaliculatus sp. nov.

Aus der Verwandtschaftsgruppe der vorigen Art. Dunkelbraun bis schwarz, Prothorax, Schildchen, und Elytren blassgelb, Schenkelbasis der vorderen beiden Beinpaare und der Kopf gelblich. Fühler in gleicher Gestalt wie *benignus*. Prothorax mit fünf, in der Mitte zuweilen undeutlichen Areolen, Vorderrand rundlich, Seitenrand fast gerade, Hinterrand geschwungen, Punktierung obsolet und unter der dichten Behaarung verborgen. Schildchen tief eingebuchtet. Rippen und Gitterung scharf vom Untergrund abgehoben, Furchengrund matt, Gitterung quadratisch oder länger als breit. Penis, Tafel 4, Fig. 5.

Länge, 7 bis 8 Millimeter; Breite (hum.), 2.

MINDANAO, Provinz Agusan, Butuan (*Baker*), 4 Männer. Holotypus in meinem Besitz.

Es ist bei Bestimmung dieser Art darauf zu achten, dass die Gitterung immer Neigung hat länger als breit zu werden, niemals querrechteckig. Der Furchengrund ist matt, glatt, die Erhöhung der Rippen und Furchen ist sehr scharfkantig. Die ganz aparte Gestalt des Penis beseitigt jeden Zweifel.

Xylobanus brevis sp. nov.

Kopf, Fühler, der ganze Unterkörper, Beine, und die Elytren unmittelbar am Hinterrand erdbraun, sonst schmutzig-gelborange, am ganzen Körper matt. Fühlerglieder schwach gezähnt, beim Mann länger als breit, beim Weib kürzer, in beiden Geschlechtern nach der Spitze verschmälert. Prothorax etwa quadratisch, mit fünf, zuweilen etwas undeutlichen Areolen, Vorderrand rundlich gewölbt. Ecken scharf, Seitenrand nach innen geschwungen, an den Hinterecken spitz vorgezogen, am Vorderrand stärker, sonst schwach punktiert. Schildchen tief eingedrückt und hinten eingekerbt. Auf den Elytren liegen die Rippen etwas höher als die ebenfalls sehr scharfe Gitterung. Form der Gitterung quadratisch, Rippen und Furchen kurz, borstig behaart. Penis, Tafel 4, Fig. 8.

Länge, 6 bis 7 Millimeter; Breite (hum.), 1.5.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*) ; Los Baños (*G. Villegas*). MINDANAO, Provinz Lanao, Kolambugan; Iligan: Provinz Surigao, Surigao (*Baker*) : Provinz Zamboanga, Port Banga (*Böttcher*). NEGROS, Cuernos Gebirge (*Baker*). SAMAR (*Baker*) ; 21 Männer und Weiber. Typen in meinem Besitz.

Die Art variiert beträchtlich: der Prothorax ist schlank, nicht quadratisch, die Areolen sind undeutlich, die Punktierung dehnt sich aus, die braune Färbung kann schwarz werden, nur die Elytren bleiben erdbraun, die gelbe Färbung kann hell werden, namentlich an den Beinen, so dass schwarze Beine mit hellgelber Schenkelbasis vorkommen. Alle Variationen sind durch Penisuntersuchung artlich sichergestellt.

Xylobanus bellus sp. nov.

Mit *barbarus* durchaus übereinstimmend, nur dass die Elytren am Hinterrand in geringem Umfange schwarz sind. Der ganz anders gebaute Penis ist in Tafel 4, Fig. 9, dargestellt, die Art ist also gesichert.

Länge, 7 Millimeter; Breite (hum), 1.75.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*). SIARGAO, Dapa; Cabuntog (*Böttcher*) ; 3 Männer, 1 Weib. Holotypus im Dresdener Museum, Allotypus in meinem Besitz.

Xylobanus quadratus sp. nov.

Abdomen schwarz, Brust orangegelb, Beine schwarzbraun, nur die Schenkelbasis gelb, Kopf und Fühler schwarzbraun, Prothorax, Schildchen, und vordere Elytrenhälfte orangegelb, hintere Hälfte schwarz, Kopf hochglänzend, sonst matt. Stirn senkrecht, ohne jede Skulptur oder Behaarung, Fühlerbeulen gross, platt, wagerecht mit flacher Mittelfurche, deutlich punktiert und anliegend behaart. Fühler lang, drittes bis elftes Glied etwa gleichlang, drittes doppelt so lang wie breit, die folgenden an Breite abnehmend, Zähnung sehr schwach, Prothorax (Tafel 4, Fig. 10), die seitlichen Areolen schwächer als die übrigen, Seitenränder aufgebogen, Punktierung einzeln, gross, Behaarung kurz. Schildchen so breit wie lang, hinten halbkreisförmig eingebuchtet. Elytren mit sehr grosser und weitläufiger, quadratischer Gitterung, Rippen und Gitterung kurz behaart. Penis, Tafel 4, Fig. 12 und 13.

Länge, 12 Millimeter; Breite (hum.), 2.8.

LUZON, Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*): Provinz Cagayan (*Jones*). Holotypus in der Sammlung des Bureau of Science zu Manila, Paratypus in meinem Besitz.

Die Art fällt durch die grosse Gitterung auf, bei keiner anderen sah ich so weitläufige und quadratische Gitterfiguren. Der Penis ist von ganz eigenartiger Gestalt. *Xylobanus quadratus* scheint mit *fragilis* einem Verwandtschaftskreis anzugehören, bei beiden Arten sah ich das Organ vorn gespalten, eine seltene Erscheinung und bisher nur bei *Xylobanus* beobachtet.

Xylobanus basilensis sp. nov.

Abdomen, die Beine mit Ausnahme der basalen Schenkelhälfte, Fühler, und die Elytren in der hinteren Hälfte schwarz bis schwarzbraun, sonst lehmgelb. Fühler pectinat, zwei bis dreimal so lang wie das Glied selbst, lang behaart. Prothorax quadratisch, Vorderrand schräg dachförmig, Vorderecken scharfkantig, Seiten nach innen flachdreieckig eingekerbt, Hinterrand schwach gebogen, Hinterecken nicht vorstehend. Elytren und Penis mit *consimilis* übereinstimmend.

Länge, 5 Millimeter; Breite (hum.), 1.25.

BASILAN (*Baker*), 1 Mann. Holotypus in meinem Besitz.

Mit *consimilis* sehr nahe verwandt, durch die Ausfärbung und den ganz anders gebauten Prothorax aber bestimmt verschieden.

Xylobanus paululus sp. nov.

In der Ausfärbung *quadratus* ähnlich, die dunklen Farbenpartieen sind aber dunkelbraun, nicht schwarz, und auf den Elytren ist nur die äusserste Basis in unscharfen Umrissen gelb; Glanz schwach. Stirn schräg, unskulptiert, in die flachen Fühlerbeulen unmerklich übergehend, letztere mit flacher Mittelfurche, kräftiger Punktierung und anliegender Behaarung; Augen gross, prominent. Fühler vom achten Glied ab tief gezähnt, nach vorn werden die Glieder schmäler, die Zähnung tiefer (Tafel 4, Fig. 15, fünftes Glied). Prothorax (Tafel 4, Fig. 16) seitliche Areolen unscharf, Punktierung klein aber tief und deutlich, Behaarung kurz. Schildchen länger als breit, hinten rundlich eingebuchtet. Elytrengitterung, Tafel 4, Fig. 17; Penis, Tafel 4, Fig. 18.

Länge, 7 Millimeter; Breite (hum.), 1.8, circa.

LUZON, Provinz Laguna, Paete (*Böttcher*); Mount Maquiling (*Baker*). MINDANAO, Provinz Lanao, Momungan (*Böttcher*). NEGROS, Canlaon Volkan (*Banks*). Zahlreiche Individuen.

Typen in der Sammlung des Bureau of Science zu Manila. Paratypen in meinem Besitz.

Dem *consentaneus* am nächsten stehend, die Fühler sind aber bei jener Art fast pectinat, bei *paululus* nur gezähnt. Penis von ganz anderer Gestalt.

Die Variation ist sehr beträchtlich, die stark gezähnten Fühler lassen aber eine sichere Klassifizierung auch im weiblichen Geschlecht zu.

Xylobanus candidus sp. nov.

Schwarz bis schwarzbraun, Prothorax, Schildchen, und Elytren im basalen Drittel orangerot, Prosternum und die Basis der Schenkel an den vorderen Beinpaaren gelblich. Fühlerglieder breit, kurz gezähnt. Prothorax lang, mit fünf, etwas verschwommenen Areolen, Punktierung undeutlich. Auf den Elytren sind die Rippen und Gitterung nur mässig erhöht, Gitterung querrechteckig, Behaarung auf Rippen und Furchen sehr kurz.

Länge, 6 bis 7 Millimeter; Breite (hum.), 1.5 bis 2.

SIBUYAN (*Baker*). SAMAR (*Baker*). NEGROS, Cuernos Gebirge (*Baker*); mehrere Männer und Weiber. Typen in meinem Besitz.

Ich kenne keine *Xylobanus*-Art von den Philippinen oder den östlichen Sunda-Inseln, die mit *candidus* collidieren könnte.

Xylobanus pullatus sp. nov.

Erdgrau, nur der Prothorax schmutzig-gelb, überall schwach behaart, mässig glänzend. Kopf ohne besondere Merkmale. Fühler schlank, drittes bis elftes Glied von gleicher Länge, drittes und die folgenden nur wenig länger als breit, nach vorn an Breite, nicht an Länge abnehmend. Prothorax quadratisch, Vorderrand rundlich, Vorderecken stumpf aber deutlich, Seiten nach innen geschwungen, gegen den Hinterrand wieder verbreitert, Hinterrand flach geschwungen, Hinterecken wenig vorgezogen, sieben Areolen, Punktierung durch die Behaarung mehr oder weniger verdeckt. Schildchen halbelliptisch eingekerbt. Elytren mit wechselnder Gitterung, meist quadratisch, aber auch lang und querrechteckig, Rippen und Gitterung fast gleich hoch. Penis, Tafel 4, Fig. 23.

Länge, 5 bis 5.5 Millimeter; Breite (hum.), 2.6.

MINDORO, San Teodoro; Calapan (*Böttcher*), 1 Mann, Weib. Holotypus im Museum Natura Artis Magistra zu Amsterdam, Allotypus in meinem Besitz.

Durch die Ausfärbung mit keiner anderen Art zu verwechseln. Beachtenswert ist das dritte Fühlerglied, das so lang wie das vierte ist. Meist ist das dritte Fühlerglied auffallend kürzer als das vierte.

Xylobanus consentaneus sp. nov.

Schwarz, Prosternum, an den Vorderbeinen die Hüften und die Schenkel bis zur Hälfte, an den Mittelbeinen wenigstens Hüften und Schenkelbasis, Prothorax und Schildchen hellgelb, Elytren zuweilen unmittelbar an der Basis etwas heller. Fühler des Mannes mit breiten Lamellen, des Weibes gezähnt, ohne Lamellen, länger als breit, männliche Fühler lang, weibliche kurz behaart. Prothorax mit sieben Areolen, quadratisch, Vorderrand flach gerundet, Ecken stumpf, Seiten flach nach innen gebogen, Hinterrand leicht geschwungen, Hinterecken mässig stark, seitliche Areolen zuweilen undeutlich, Punktierung nur in den vorderen Areolen dichter. Alle Rippen auf den Elytren scharf entwickelt, Gitterung querrechteckig aber nicht schmal, eher mit Neigung zur Quadratform; Behaarung kurz.

Länge, 4.5 bis 6 Millimeter; Breite (hum.), 1.25 bis 1.5.

LUZON, Mount Banahao (*Baker*). MINDANAO, Provinz Surigao, Surigao (*Baker*). SIBUYAN (*Baker*) ; 3 Männer, 3 Weiber. Typen in meinem Besitz.

Habituell *clandestinus* ähnlich, aber in dem männlichen Geschlecht durch die pectinaten Fühler und den andersgebauten Penis unterschieden, im weiblichen Geschlecht sind die Fühlerglieder länger als bei *clandestinus*, so dass sie Trennung sicher vorzunehmen ist.

Xylobanus pudicus sp. nov.

Schwarzbraun, Hüften aller Beine, Schenkelbasis der Vorderbeine, Prosternum, Prothorax, und Schildchen orangegelb, zuweilen auch die Elytren unmittelbar an der Basis mit einem hellen Anflug. Das dritte Fühlerglied in beiden Geschlechtern dreieckig, die folgenden länger als breit, nach vorn an Breite, nicht an Länge abnehmend, die Fühler des Weibes sind vom vierten Glied ab schlanker, schmäler, die vorderen Glieder mehr als doppelt so lang wie breit. Prothorax wie bei *luzonicus*. Elytrengitterung quadratisch, seltener querrechteckig, Gitterung weniger tief als die Rippen.

Länge, 6 bis 6.5 Millimeter; Breite (hum.), 2.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*). SIBUYAN (*Baker*) ; 1 Mann, 2 Weiber. Holotypus in meinem Besitz, Allotypus im Museum Natura Artis Magistra zu Amsterdam.

Von den ganz ähnlichen *consentaneus* durch die nicht pectinaten Fühler und den gänzlich anderen Penis leicht zu trennen.

Xylobanus fragilis sp. nov.

Abdomen und Beine schwarzbraun, Brust gelb, Kopf schwarzbraun, Mandibeln und die Mandibularpalpen mit Ausnahme des letzten Gliedes gelb, Fühler, Prothorax, Schildchen, und die hintere Hälfte bis zwei Drittel der Elytren schwarzbraun, Basalteil schmutzig-gelb, Elytren dicht behaart. Fühler in beiden Geschlechtern von gleicher Gestalt, gezähnt, die basalen so breit wie lang, nach vorn an Breite abnehmend und daher länger als breit, das neunte bis elfte schlank. Prothorax etwa quadratisch, Vorderrand gerundet, Vorderecken stumpf, Seiten fast gerade, in der Mitte schwach nach innen verengt, Hinterrand flachgeschwungen, Hinterecken rechtwinklig, nicht vorgezogen, Areolen alle sehr scharfkantig getrennt, Punktierung gering. Schildchen flach eingekerbt. Elytren mit stark erhöhten Rippen und kräftiger Gitterung, Gitter meist quadratisch, seltener lang- oder querrechteckig.

Länge, 8 bis 10 Millimeter; Breite (hum.), 2, circa.

MINDANAO, Provinz Lanao, Iligan: Provinz Zamboanga, Zamboanga (*Baker*): Provinz Surigao, Surigao (*Baker, Böttcher*). BASILAN (*Baker*). SAMAR, Catbalogan (*Baker, Böttcher*); 4 Männer, 4 Weiber. Typen in meinem Besitz.

Schon durch die Ausfärbung, die bei keiner anderen Art des Verbreitungsgebietes wiederzufinden ist, ist die Trennung leicht. Der Penis sichert die Art durch seinen charakteristischen Form. Prothorax und Schildchen können gelb sein, so dass man annehmen könnte, es handele sich um eine eigene Art. Der Penisbefund hat die Einheitlichkeit der Art aber bewiesen. Die verschiedenen Formen kommen bei beiden Geschlechtern und an demselben Fundort vor.

Xylobanus bicoloratus sp. nov.

Kopf schwarz, Fühler dunkelbraun, Prothorax schwarzbraun, nur die Seitenränder gelblich, Schildchen schwarz, Elytren im basalen Drittel bleichgelb, sonst hellerdbraun. Beine und Unterkörper wie die Fühler gefärbt. Fühler schlank, Glieder vom dritten ab langgezähnt, dicht kräftig behaart. Prothorax mit sieben Areolen, Vorderrand flach gewölbt, Seiten flach nach innen gebogen, Hinterrand wellig geschwungen, Punktierung in den vorderen Areolen grob, sonst undeutlich. Elytrenrippen höher als die Gitterung, letztere quadratisch bis querrechteckig, dicht und lang behaart, Elytren in der Gitterung glänzend. Penis, Tafel 4, Fig. 32.

Länge, 8 bis 10 Millimeter; Breite (hum.), 2.

LUZON, Subprovinz Benguet, Pauai (Haight's Place), 8,000 Fuss (*Böttcher*). MINDANAO, Provinz Agusan, Butuan (*Baker*); 1 Mann. Holotypus in meinem Besitz.

Durch die schlanke Gestalt, die langen Fühler und weissgelbe Farbe der hellen Körperpartieen leicht zu erkennen.

Xylobanus consociatus sp. nov.

Braunschwarz bis schwarz, Prothorax lehmgelb, in der Mitte schwärzlich, Schildchen schwarz, Elytren in der basalen Hälfte lehmgelb, Spitzenhälfte schwarz. Fühlerglieder gezähnt, so breit wie lang, behaart. Prothorax länger als breit, Vorderrand sehr kurz, Seiten ganz allmählich schräg nach aussen erweitert, Hinterrand geschwungen, sieben Areolen, die hinteren tief eingesenkt. Elytren mit scharfen Rippen, von denen die erste auf der Mitte verschwindet, sonst gleich *consimilis*.

Länge, 6 Millimeter; Breite (hum.), 1.5.

LUZON, Provinz Bataan, Lamao (*Böttcher*). MINDANAO, Provinz Agusan, Butuan (*Baker*). MINDORO, Calapan (*Böttcher*); mehrere Weiber. Typen in meinem Besitz.

Ich kenne keine Art, die einen ähnlichen Prothorax besitzt, es ist übrigens die einzige, deren erste Rippe verkürzt ist. Da aber kein Mann vorliegt und alle Eigenschaften durchaus mit *Xylobanus* übereinstimmen, so trage ich kein Bedenken, die neue Art in der Gattung zu lassen.

Xylobanus luzonicus sp. nov.

Dem *consociatus* in der Ausfärbung gleich. Fühler in beiden Geschlechtern von fast gleicher Gestalt, das dritte Glied dreieckig, das vierte länger als breit, dreieckig, die folgenden an Breite, nicht an Länge abnehmend, das dritte bis zehnte Glied stumpf gezähnt, alle Glieder mit breiten, glänzenden Haaren besetzt. Prothorax quadratisch, Vorderrand rundlich-dachförmig abfallend, Vorderecken stumpf, Seiten gerade, Hinterrand flach geschwungen, Hinterecken rechteckig, alle Areolen scharfrippig, die in den Vorderrand einmündenden, mit Ausnahme der discoidalen, durch grobe Punktierung undeutlich, Punktierung an den Seiten schwach; Behaarung kurz. Schildchen dreieckig eingekerbt. Elytrengitterung quadratisch bis querrechteckig, wenig tiefer als die Rippen liegend, kurz, anliegend, dicht behaart. Penis, Tafel 4, Fig. 37.

Länge, 7 Millimeter; Breite (hum.), 2.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*), 1 Mann. Holotypus im Museum Natura Artis Magistra, Paratypus in meinem Besitz.

Von *consociatus* durch den gänzlich anders gebauten Prothorax leicht zu trennen.

Uebersicht über die philippinischen Xylobanus-Arten.

1. Einfarbig schwarz .... 2.
   Anders gefärbt .... 5.
2. Prothorax mit sieben Areolen .... 3.
   Prothorax mit fünf Areolen .... 4.
3. Drittes bis zehntes Fühlerglied dreieckig, kräftig gezähnt, Prothorax mit vorgezogenen Hinterecken; Penis, Tafel 3, Fig. 41. **X. blandus sp. nov.**
   Drittes bis zehntes Fühlerglied länger als breit, nicht gezähnt, Prothorax mit rechtwinkligen Hinterecken; Penis, Tafel 3, Fig. 44 und 45. **X. benignus sp. nov.**
4. Oberseite des Körpers dicht behaart, Prothorax ohne sichtbare Punktierung .... **X. lanatus sp. nov.**
   Oberseite des Körpers glänzend, Prothorax am Vorderrand und an den Seitenrändern kräftig punktiert .... **X. nitidus sp. nov.**
5. Prothorax, Schildchen, und Elytren gelbrot oder lehmgelb .... 6.
   Prothorax schwarz oder bunt .... 21.
6. Elytren ganz gelbrot .... 7.
   Elytren wenigstens am Hinterrand schwach verdunkelt .... 12.
7. Fühler mit langen Lamellen .... 8.
   Fühler ohne Lamellen .... 9.
8. Lamellen schmal, parallel, Prothorax mit undeutlichen Areolen; kleine Art .... **X. consimilis sp. nov.**
   Lamellen langelliptisch, Prothorax mit scharfen Areolen; grosse Art. **X. consobrinus sp. nov.**
9. Prothorax mit sieben Areolen .... **X. pubens sp. nov.**
   Prothorax mit fünf Areolen .... 10.
10. Elytrengitterung länger als breit; Penis, Tafel 4, Fig. 5. **X. canaliculatus sp. nov.**
    Elytrengitterung querrechteckig, seltener quadratisch .... 11.
11. Lehmgelb bis rotorange; Penis, Tafel 4, Fig. 1 .... **X. caelestis sp. nov.**
    Bleichgelb; Penis, Tafel 4, Fig. 3 .... **X. barbarus sp. nov.**
12. Auf den Elytren erreicht die dunkle Spitzenpartie nicht die Mitte .... 13.
    Geht meist über die Mitte hinaus .... 14.
13. Die Verdunkelung der Elytren ist nur schwach, nur am Hinterrand vorhanden, gegen die hellen Partieen unscharf abgegrenzt; Penis, Tafel 4, Fig. 8 .... **X. brevis sp. nov.**
    Die Verdunkelung ist tief, gegen die hellen Partieen scharf abgegrenzt; Penis, Tafel 4, Fig. 9 .... **X. bellus sp. nov.**
14. Grosse Art (12 bis 14 Millimeter); basale Hälfte der Elytren ziegelrot, Spitzenhälfte tiefschwarz; Penis, Tafel 4, Fig. 12 und 13. **X. quadratus sp. nov.**

Kleine Arten (7 bis 8 Millimeter), die hellen Farbenpartieen auf den Elytren nur an der Basis und lehmgelb .... 15.
15. Fühler des Mannes pectinat .... **X. basilensis** sp. nov.
Fühler nicht pectinat .... 16.
16. Fühlerglieder vom dritten bis zehnten tief gezähnt .... **X. paululus** sp. nov.
Nicht gezähnt .... 17.
17. Elytren im basalen Drittel orangerot .... 18.
Elytren einfarbig schwarz oder erdgrau .... 19.
18. Prothorax mit sieben deutlichen Areolen .... **X. fragilis** sp. nov.
Prothorax mit fünf Areolen .... **X. candidus** sp. nov.
19. Elytren erdgrau, Prothorax schmutzig-gelb .... **X. pullatus** sp. nov.
Elytren ganz schwarz, Prothorax orangegelb .... 20.
20. Fühler pectinat .... **X. consentaneus** sp. nov.
Fühler nicht pectinat .... **X. pudicus** sp. nov.
21. Prothorax schwarz .... **X. fragilis** sp. nov.
Prothorax bunt .... 22.
22. Fühlerglieder schlank, das dritte bedeutend länger als breit, die hellen Körperpartieen bleichgelb .... **X. bicoloratus** sp. nov.
Fühler gedrungen, drittes Glied dreieckig .... 23.
23. Prothorax länger als breit, Punktierung sehr zart. **X. consociatus** sp. nov.
Prothorax quadratisch, Punktierung kräftig, dicht. **X. luzonicus** sp. nov.

Genus METANOEUS Waterhouse

Metanoeus WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 73.

Die kleine Gattung ist nur aus dem orientalischen Gebiet bekannt. Habituell ist sie gut abgeschlossen und lässt keinen Zweifel über ihren Umfang aufkommen. Auf den Philippinen fanden sich zwei Arten vor.

Metanoeus bakeri sp. nov.

Abdomen und die Beine mit Ausnahme der Schenkelbasis schwarzbraun, Fühler und Kopf hellbraun, sonst orangerot; durch die starke Pubescens des ganzen Oberkörpers seidenglänzend. Fühlerglieder 3 bis 10 mit langen, schmalen Lamellen, die etwa viermal so lang wie das Glied selbst sind. Prothorax etwa viereckig, Vorderrand gerundet, Seiten fast gerade, Hinterrand flach gewellt, Hinterecken wenig stark, Areolen sehr undeutlich, Punktierung schwach. Schildchen hinten tief eingekerbt. Primärrippen der Elytren kräftig, Sekundärrippen ganz obsolet und nur durch die Gitterung kenntlich, Gitterung langoval-rechteckig bis rundlich-quadratisch, meist sind die Einzelfiguren rundlich.

Länge, 7 bis 8 Millimeter; Breite (hum.), 2.

LUZON, Provinz Laguna, Mount Maquiling; Los Baños (*Baker*): Subprovinz Benguet, Baguio (*Baker*): Subprovinz Bontoc, Mount Polis, 2,400 Fuss (*Böttcher*): Subprovinz Kalinga, Balbalasan, 4,000 bis 5,000 Fuss (*Böttcher*): Provinz Sorsogon, Mount Bulusan (*Böttcher*). MINDANAO, Provinz Agusan, Butuan (*Baker*): Provinz Lanao, Kolambugan (*Baker, Böttcher*); Iligan (*Baker*); Momungan (*Böttcher*): Provinz Surigao, Surigao (*Baker, Böttcher*): Provinz Zamboanga, Zamboanga (*Baker*); Dapitan (*Baker*); Port Banga (*Böttcher*): Provinz Davao, Davao (*Baker*). BASILAN (*Baker, Böttcher*). DINAGAT (*Böttcher*). LEYTE, Burauen; Santa Cruz (*Böttcher*). NEGROS, Cuernos Gebirge (*Baker*); 70 Männer, 18 Weiber. Typen in meinem Besitz.

Die neue Art ist dem unermüdlichen Erforscher der philippinischen Insectenfauna gewidmet. Variationen konnte ich nicht feststellen. Die Weiber haben nur gezähnte Fühler. Aehnlichkeit besteht mit *fulvus* Waterhouse von Penang, der Prothorax hat aber eine ganz andere Form. Auffallend ist die grosse Differenz in der Zahl der Geschlechter.

Metanoeus cognatus sp. nov.

Mit *bakeri* in der Ausfärbung durchaus übereinstimmend, nur sind die Elytren am Hinterrand tief schwarz. Fühler und Prothorax wie bei *bakeri*, auf dem Prothorax ist die Ausbildung der Areolen deutlicher als bei *bakeri*. Penis von ganz anderer Gestalt (Tafel 4, Fig. 40).

Länge, 8 bis 10 Millimeter; Breite (hum.), 2.

MINDANAO, Provinz Lanao, Kolambugan (*Baker*). SIBUYAN (*Baker*). NEGROS, Cuernos Gebirge (*Baker*). NORDWEST PANAY (*Baker*); 14 Männer, 14 Weiber. Typen in meinem Besitz.

Wesentliche Differenzen in der Ausfärbung waren nicht nachzuweisen. Der Umfang der Art ist in dem männlichen Geschlecht durch den komplizierten Penis leicht bestimmbar, aber auch im weiblichen Geschlecht ist die Bestimmung durch die Ausfärbung sicher. Eine kollidierende Art ist nicht bekannt.

Metanoeus cognatus habe ich in dem grossen Böttcher'schen Material nicht aufgefunden.

Bestimmungstabelle der philippinischen Metanoeus-Arten.

Elytren ganz gelb.. **M. bakeri** sp. nov.
Elytren mit schwarzem Hinterrand.......................... **M. cognatus** sp. nov.

Genus **PROTAPHES** Kleine

Die Gattung dürfte im Wesentlichen orientalisch sein; von den Philippinen fand ich nur eine Art.

Protaphes confertulus Kleine.

LUZON, Provinz Laguna, Mount Maquiling; Mount Banahao (*Baker*). MINDANAO, Provinz Davao, Davao (*Baker*): Provinz Agusan, Butuan (*Baker*); Cabadbaran (*Weber*): Provinz Lanao, Iligan (*Baker*): Provinz Surigao, Surigao (*Baker*). SIARGAO, Cabuntog (*Böttcher*). MINDORO, Calapan (*Böttcher*).

Genus **TAPHES** Waterhouse

Taphes WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 62.

Die Gattung ist orientalisch, von den Philippinen ist nur die nachstehende Art bekannt geworden.

Taphes acceptus sp. nov.

Prothorax, Elytren im basalen Drittel, Pro- und Mesosternum, und die beiden ersten Schenkelpaare in der basalen Hälfte chromgelb, sonst schwarz. Scheitel neben der Mitte punktartig eingedrückt, Gesicht zurückgebogen, mit einem von den Fühlern kommenden, sich über den Mund seitlich teilenden, scharfen Mittelkiel. Fühler seitlich zusammengedrückt, von normaler Gestalt. Prothorax breiter als lang, Vorderrand halbelliptisch, Hinterrand flach gewellt, Schildchen stumpf gerundet. Elytren mit vier Rippen, erste Rippe im letzten Viertel verschwindend, zweite und dritte vor dem Rand vereinigt und gestielt dem Rand zustrebend, vierte normal.

Länge, 6.5 bis 8 Millimeter; Breite (hum.), 2.

LUZON, Provinz Laguna, Los Baños (*Baker*): Provinz Nueva Vizcaya (*Baker*). MINDANAO, Provinz Surigao, Surigao (*Baker*). NEGROS, Cuernos Gebirge (*Baker*). MINDORO, San Teodoro (*Böttcher*); 10 Männer, Weiber. Typen in meinem Besitz.

Bei den Exemplaren von Negros ist die rote Farbe nur noch dicht an der Elytrenbasis vorhanden, das Exemplar von Mindoro war ganz dunkel. Die Farbenvariation ist also sehr bedeutend. Die Uebereinstimmung aller Stücke ist durch Penisvergleich gesichert.

Genus **LEPTOTRICHALUS** Kleine

Leptotrichalus KLEINE, Philip. Journ. Sci. 28 (1925) 295.

Die grösste Zahl der *Leptotrichalus*-Arten ist von den Philippinen bekannt. Auf den Molukken scheint die Gattung nicht weit vorgedrungen zu sein, wenigstens habe ich sie nicht über Celebes hinausgehen gesehen, und in dem ansehnlichen papuanischen Material das mir vorgelegen hat, fehlte sie gänzlich. Im orientalischen Gebiet westlich der Philippinen ist die Artzahl nur gering.

Leptotrichalus cyaneiventris Waterhouse.

Leptotrichalus cyaneiventris WATERHOUSE, Ill. Typ. Spec. Col. Lycidæ 1 (1879) 72, t. 17, f. 6.

LUZON, Mount Banahao (*Böttcher, Banks*) : Provinz Laguna, Mount Maquiling (*Baker*) ; Los Baños (*Böttcher, Villegas*) ; Santa Maria (*Rivera*) : Subprovinz Benguet, ohne nähere Angabe (*McGregor*) ; Trinidad, 4,000 Fuss (*Böttcher*) ; Baguio (*Baker*) : Provinz Tayabas, Casiguran (*Böttcher*) : Provinz Nueva Vizcaya, Imugan, 2,000 Fuss (*Böttcher*). MINDANAO, Provinz Agusan, Butuan (*Baker*) : Provinz Zamboanga, Zamboanga (*Baker*) : Provinz Davao, Davao (*Baker*) : Provinz Lanao, Kolambugan (*Baker*) : Momungan (*Böttcher*) : Provinz Surigao, Surigao (*Böttcher*). POLILLO (*Böttcher*). SAMAR (*Baker*). PANAY (*Baker*).

Im Böttcher'schen Material fanden sich 40 Männer und 15 Weiber.

Leptotrichalus celsus Kleine.

Leptotrichalus celsus KLEINE, Philip. Journ. Sci. 28 (1925) 301.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*) : Provinz Bataan, Lamao (*Böttcher*) : Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*). MINDANAO, Provinz Surigao, Surigao (*Baker, Böttcher*) : Provinz Agusan, Butuan (*Böttcher*) : Provinz Zamboanga, Port Banga (*Böttcher*) : Provinz Lanao, Momungan (*Böttcher*). POLILLO (*Böttcher*). SIARGAO, Cabuntog (*Böttcher*). SAN MIGUEL (Provinz Samar) (*Böttcher*).

Gesehen, 66 Männer, 42 Weiber.

Leptotrichalus accuratus Kleine.

Leptotrichalus accuratus KLEINE, Philip. Journ. Sci. 28 (1925) 304.

LUZON, Mount Banahao; Mount Maquiling; Los Baños (*Baker*). MINDANAO, Provinz Agusan, Butuan (*Baker*). SIBUYAN (*Baker*).

In der Böttcher'schen Ausbeute nicht gefunden.

Leptotrichalus femoralis Kleine.

Leptotrichalus femoralis KLEINE, Philip. Journ. Sci. 28 (1925) 309.

MINDANAO, Provinz Surigao, Surigao (*Baker, Böttcher*) ; Provinz Lanao, Kolambugan; Momungan (*Böttcher*) ; Iligan (*Ba-*

ker): Provinz Agusan, Butuan (*Baker*). SAMAR, Catbalogan (*Böttcher*). PANAON (*Böttcher*).

Gesehen, 31 Männer, 5 Weiber.

Die Stärke der Schenkel wechselt.

Leptotrichalus dubitabilis Kleine.

Leptotrichalus dubitabilis KLEINE, Philip. Journ. Sci. 28 (1925) 302.

LUZON, Laguna, Mount Maquiling (*Baker*); Los Baños; Mount Banahao, 2,000 Fuss (*Böttcher*); Santa Maria (*Rivera*): Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*): Provinz Nueva Vizcaya, Balete Pass (*Schultze*): Provinz Tayabas, Casiguran (*Böttcher*). POLILLO (*Baker, Böttcher*). MINDANAO, Provinz Surigao, Surigao: Provinz Lanao, Kolambugan; Momungan: Provinz Zamboanga, Port Banga (*Böttcher*). SIBUYAN (*Baker*). SIARGAO, Dapa; Cabuntog (*Böttcher*). SAMAR (*Böttcher*). SAN MIGUEL (Provinz Samar) (*Böttcher*). NEGROS, Cuernos Gebirge (*Baker*).

Gesehen, 115 Männer, 89 Weiber.

Leptotrichalus cereus Kleine.

Leptotrichalus cereus KLEINE, Philip. Journ. Sci. 28 (1925) 301.

LUZON, Mount Banahao, 2,000 Fuss (*Böttcher*). MINDANAO, Provinz Agusan, Butuan (*Baker*): Provinz Surigao, Surigao (*Baker, Böttcher*): Provinz Lanao, Kolambugan (*Baker*); Momungan (*Böttcher*); 11 Männer, 1 Weib.

Keine häufige Art, keine Variationen gesehen.

Leptotrichalus acidus Kleine.

Leptotrichalus acidus KLEINE, Philip. Journ. Sci. 28 (1925) 302.

LUZON, Provinz Laguna, Mount Maquiling; Mount Banahao (*Baker*). SIBUYAN (*Baker*).

Im Böttcher'schen Material habe ich diese Art nicht aufgefunden.

Leptotrichalus acutus Kleine.

Leptotrichalus acutus KLEINE, Philip. Journ. Sci. 28 (1925) 302.

LUZON, Provinz Laguna, Los Baños, Mount Maquiling (*Baker*); Mount Banahao (*Baker, Böttcher*): Subprovinz Kalinga, Lubuagan (*Böttcher*).

Im Böttcher'schen Material fanden sich 2 Männer und 10 Weiber.

Keine häufige Art, Variation sehr gering.

Leptotrichalus acerbus Kleine.

Leptotrichalus acerbus KLEINE, Philip. Journ. Sci. 28 (1925) 303.

LUZON, Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Baker, Böttcher*) : Provinz Camarines Sur, Mount Isarog, 4,000 Fuss (*Böttcher*) : Provinz Laguna, Los Baños (*Villegas*) ; Mount Banahao, 2,000 Fuss (*Böttcher*) : Subprovinz Kalinga, Lubuagan, 3,500 Fuss (*Böttcher*).

Im Böttcher'schen Material fanden sich 406 Exemplare.

Die Art variiert in der Grösse fast garnicht, dagegen kann der Prothorax hell werden, kann aber auch völlig schwarz sein. Einfarbige Individuen sind keine eigene Art, wie die Penisuntersuchung ergeben hat. Die Gestalt des Prothorax wechselt auch insofern, als die Ränder sehr stark aufgebogen sein können. Die schwarzen Individuen haben oft einen sehr flachen Prothorax und lassen die Ansicht aufkommen dass eine eigene Art vorliegt. Die schwarzen Individuen scheinen von einer speciellen Localität herzustammen. An einer anderen Stelle als Nord-Luzon waren die dunklen Formen nicht zu finden.

Leptotrichalus adolescens Kleine.

Leptotrichalus adolescens KLEINE, Philip. Journ. Sci. 28 (1925) 305.

LUZON, Provinz Laguna, Mount Maquiling (*Baker*).

Im Böttcher'schen Material nicht aufgefunden.

Leptotrichalus dispar sp. nov.

Abdomen, Brust, Tarsen, das erste bis dritte Fühlerglied braun in wechselnder Tiefe, Beine mit Ausnahme der Tarsen gelb, Prothorax, Schildchen, und Elytren von gleicher Farbe, letztere am Hinterrand schwach verdunkelt. Kopf mit ganz kurzem Rüssel, Stirn dunkelbraun, glatt, zum Teil dicht punktiert. Fühler ohne besondere Merkmale. Prothorax von üblicher Gestalt, Vorderrand rund, Hinterrand in der Mitte vorgezogen. Schildchen schmal-dreieckig eingekerbt, erste Primärrippe bis zur Hälfte reichend, zweite sehr kurz, die folgenden bis zum Hinterrand verlängert, Sekundärrippen in der hinteren Hälfte so stark wie die Primärrippen. Beim Mann sind alle Rippen gleich hoch, die Elytren daher flach, an der Sutura geschlossen, beim Weib sind die erste und dritte Primärrippe stark vergrössert, verbreitert, und erhöht, und ziehen die Elytren auseinander, so dass sie an der Sutura Stark klaffen. Penis, Tafel 4, Fig. 41.

Länge, 5.5 bis 8 Millimeter; Breite (hum.), 1.8 bis 2.2.

MINDORO, Mangarin (*Böttcher*), 208 Männer und Weiber. Typen in meinem Besitz.

Variationen waren nicht nachzuweisen. Von allen anderen Arten durch die Anordnung der Rippen sofort zu unterscheiden. Es ist die einzige Art, bei der sexuelle Dimorphie festgestellt worden ist.

Leptotrichalus circumscriptus Kleine.

Leptotrichalus circumscriptus KLEINE, Philip. Journ. Sci. 28 (1925) 307.

MINDANAO, Provinz Surigao, Surigao: Provinz Agusan, Butuan (*Baker*).

Im Böttcher'schen Material nicht gefunden worden.

Leptotrichalus effeminautus Kleine.

Leptotrichalus effeminatus KLEINE, Philip. Journ. Sci. 28 (1925) 306.

MINDANAO, Provinz Surigao, Surigao: Provinz Lanao, Kolambugan (*Baker*).

Im Böttcher'schen Material nicht aufgefunden.

Leptotrichalus cicatricosus Kleine.

Leptotrichalus cicatricosus KLEINE, Philip. Journ. Sci. 28 (1925) 307.

LUZON, Subprovinz Bontoc, Mount Polis, 2,400 Fuss: Mount Banahao, 2,000 Fuss: Provinz Camarines Sur, Mount Isarog, 4,000 Fuss: Provinz Laguna, Los Baños (*Böttcher*). MINDANAO, Provinz Surigao, Surigao (*Baker, Böttcher*). LEYTE, Burauen (*Böttcher*): Provinz Lanao, Momungan (*Böttcher*). NEGROS, Cuernos Gebirge (*Baker*). MINDANAO, Calapan (*Böttcher*); 34 Männer, 20 Weiber.

Die schwarzen Farbenpartieen auf den Elytren wechseln sehr in der Ausdehnung. Der Prothorax kann auch braun werden. Grössenunterschiede sind nicht sehr bedeutend. Die ersten Fühlerglieder können hell werden.

Leptotrichalus adjunctus Kleine.

Leptotrichalus adjunctus KLEINE, Philip. Journ. Sci. 28 (1925) 307.

LUZON, Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*): Provinz Laguna, Mount Banahao (*Baker*): Subprovinz Benguet, Baguio (*Baker*). SIBUYAN (*Baker*).

Zehn Männer, 11 Weiber im Böttcher'schen Material gesehen.

Leptotrichalus admirabilis Kleine.

Leptotrichalus admirabilis KLEINE, Philip. Journ. Sci. 28 (1925) 308.

LUZON, Provinz Laguna, Mount Maquiling, Mount Banahao (*Baker*).

Die Art war im Böttcher'schen Material nicht vorhanden.

Bestimmungstabelle der philippinischen Leptotrichalus-Arten.

1. Oberseite des Körpers einfarbig rotorange bis lehmgelb, Elytren im Spitzenteil nicht schwarz .... 2.
   Oberseite des Körpers ganz schwarz, wenigstens die Elytren im Spitzenteil mehr oder weniger schwarz oder graubraun .... 7.
2. Hinterschenkel stark verdickt und gedornt (Mann) oder verbreitert und seitlich comprimiert (Weib) .... **L. femoralis** Kleine.
   Schenkel normal .... 3.
3. Penis vorn verbreitert, Präputialteil langelliptisch, breiter als der Stiel. **L. cyaneiventris** Waterhouse.
   Penis von verschiedener Gestalt, vorn aber nicht verbreitert .... 4.
4. Penis vorn keulig verdickt .... **L. celsus** Kleine.
   Nicht keulig verdickt .... 5.
5. Penis vor dem erweiterten Präputium taillenartig verengt. **L. accuratus** Kleine.
   Penis vorn spitz zulaufend .... 6.
6. Penis mit sehr grossem Präputialteil und langer, dorniger Einlage. **L. dubitabilis** Kleine.
   Penis langelliptisch zugespitzt .... **L. cereus** Kleine.
7. Einfarbig schwarze Arten .... 8.
   Nur zum Teil und dann auf den Elytren schwarz oder dunkel .... 9.
8. Penis mit spitzem Präputium .... **L. acidus** Kleine.
   Penis mit keuligem Präputium .... **L. acutus** Kleine.
9. Es ist nur der Prothorax ganz oder zum Teil gelb, Elytren schwarz, ganz selten ist auch die Basis in geringer Ausdehnung gelb .... 10.
   Die dunklen Partieen auf den Elytren liegen immer im Spitzenteil, und nehmen selten mehr als die Hälfte des Organs ein .... 11.
10. Penis hinter dem Präputium taillenartig verengt .... **L. accuratus** Kleine.
    Penis filiform, Präputium etwas erweitert, unterseits mit blattartigen Anhängen .... **L. acerbus** Kleine.
11. Elytrenspitze nur hellbraun angedunkelt .... 12.
    Elytrenspitze dunkelbraun bis schwärzlich .... 13.
12. Penis mit linealen Anhängen, Elytrenrippen beim Weib nicht erhöht. **L. adolescens** Kleine.
    Penis mit blattartigen Ausstülpungen des Präputiums, Elytrenrippen beim Weib zum Teil erhöht .... **L. dispar** sp. nov.
13. Erste und zweite Rippe stark verkürzt, dritte auffallend erhöht. **L. circumscriptus** Kleine.
    Nur die erste Rippe verkürzt, alle anderen normal lang, nicht auffällig erhöht .... 14.
14. Präputium nicht keulig verdickt .... **L. effeminatus** Kleine.
    Präputium keulig verdickt .... 15.
15. Penis vor dem erweiterten Präputium zungenförmig, schmal. **L. cicatricosus** Kleine.
    Nicht zungenförmig, schmal .... 16.
16. Präputium seitlich mit hyalinen Stellen .... **L. adjunctus** Kleine.
    Ohne hyaline Stellen, unterseits mit saugnapfartigen Platten. **L. admirabilis** Kleine.

Genus TRICHALUS Waterhouse

Trichalus WATERHOUSE, Trans. Ent. Soc. London (1877) 82.

Die Gattung ist weitverbreitet und sehr einheitlich im Habitus. In dem mir vorliegenden grossen Material fand ich drei Arten vor, eine vierte musste zurückgestellt werden, weil kein Mann vorlag und bei der grossen Variationsbreite der Arten ohne Penisautopsie keine sichere Bestimmung möglich ist.

Es sind zwei Arten von Bourgeois von den Philippinen bekannt gemacht. Ich kann mir keine Vorstellung von den Arten machen und glaube fast dass beide zu *Leptotrichalus* gehören und vielleicht mit einer oder der anderen von mir beschriebenen Art identisch sind. Ohne Typenvergleich ist aber nichts zu machen.

(?) **Trichalus nigricauda** Bourgeois.

Trichalus nigricauda BOURGEOIS, Ann. Soc. Ent. Fr. VI 6 (1886) 181.

(?) **Trichalus longicollis** Bourgeois.

Trichalus longicollis BOURGEOIS, Ann. Mus. Civ. Stor. Nat. Gen. 18 (1883) 646.

Trichalus clypeatus sp. nov.

Kopf, Fühler, und Unterseite des Körpers schwarzbraun, Prothorax und Elytren schmutzig-gelb, ein brauner Streifen zieht sich über die Mitte des Prothorax, über das Schildchen und die Suturalpartie der Elytren in der hinteren Hälfte. Mittlere Fühlerglieder stark gezähnt. Auf den Elytren liegen die Sekundärrippen sehr tief und sind undeutlich, Gitterung scharfkantig, wechselnd vier- oder fünfeckig.

Länge, 6.5 bis 8 Millimeter; Breite (hum.), 1.75.

MINDANAO, Provinz Lanao, Kolambugan (*Baker, Böttcher*); Dansalan (*Böttcher*): Provinz Agusan, Butuan: Provinz Bukidnon, Tangkulan: Provinz Davao, Davao (*Baker*): Provinz Surigao, Surigao (*Baker, Böttcher*). SAMAR (*Baker*). PALAWAN, Iwahig (*Weber*); 12 Männer, 14 Weiber. Typen in meinem Besitz.

Die Weiber haben gedrungene Fühlerglieder.

Die Variation der schwarzen Zeichnung ist auf der Körperoberseite sehr bedeutend, fehlt auf der Unterseite aber vollständig. Die Ausdehnung der schwarzen Partieen kann so gross werden dass nur ganz geringe gelbe Flecken übrig bleiben, andrerseits kann die Schwarzfärbung bis auf Reste an der Sutura und an der Elytrenspitze verschwinden. Die Fühlerglieder in ihrer spitzen Form trennen leicht von ähnlichen Arten.

Trichalus absonus sp. nov.

Dunkelerdbraun bis schwarz, Prothorax und Schildchen, sehr vereinzelt auch die Basis der Elytren, orangerot bis gelblich. Mittlere Fühlerglieder gezähnt. Prothorax am Vorderrand und in den Vertiefungen mit einzelnen, groben, meist flachen Punkten, die am Vorderrand tiefer und enger sind. Elytrengitterung meist fünfeckig.

Länge, 8.5 bis 10 Millimeter; Breite (hum.), 2 bis 2.2.

LUZON, Provinz Laguna, Mount Maquiling, Los Baños (*Baker*): Provinz Bataan, Lamao (*Schultze, Böttcher*): Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*). MINDORO, Calapan (*Böttcher*). MASBATE, Aroroy (*Böttcher*). SIBUYAN (*Baker*). PANAY (*Baker*). NEGROS, Cuernos Gebirge (*Baker*); 20 Männer und Weiber gesehen. Typen in meinem Besitz.

Die Variationsbreite ist sehr gross, wenigstens was die Ausfärbung anbetrifft. Meist sind Prothorax und Schildchen gelb, die Elytren dagegen schwarz, die helleren Farben können sich aber auch auf die Elytren ausdehnen und das ganze vordere Drittel einnehmen. Es kommen auch ganz einfarbige Individuen, wenn auch selten, vor. Zur sicheren Feststellung ist Penisautopsie erforderlich.

Trichalus costilis sp. nov.

Fühler, Kopf, Beine mit Ausnahme der Schenkelbasis, Abdomen und die Elytren in den hinteren zwei Dritteln erdbraun bis grau, sonst gelblich bis weissgelb. Mittlere Fühlerglieder erheblich länger als breit, kräftig gezähnt. Areole auf dem Prothorax den Vorderrand nicht erreichend, sondern durch einen flachen, undeutlichen Kiel verbunden, Punktierung sehr grob, am Vorderrand breit, sonst schmal. Elytren mit starken Primär- und flachen Sekundärrippen, Gitterung aus wechselnden Figuren bestehend. Penis, Tafel 4, Fig. 49.

Länge, 6 bis 7 Millimeter; Breite, 1.75.

LUZON, Provinz Laguna, Mount Banahao, 2,000 Fuss (*Böttcher*): Provinz Nueva Vizcaya, Imugan, 4,000 Fuss (*Böttcher*). MINDANAO, Provinz Bukidnon, Tangkulan: Provinz Lanao, Iligan (*Baker*). NEGROS, Cuernos Gebirge (*Baker*); 2 Männer, 3 Weiber. Typen in meinem Besitz.

Die Ausfärbung ist wechselnd, die hellen Partieen können gelb bis weissgelb werden, die dunklen werden fast schwarz. Auch die Ausdehnung der dunklen Partieen ist wechselnd. Beim Weib muss die Gestalt der Fühlerglieder und die Skulptur des Prothorax ausschlaggebend für sichere Bestimmung sein.

Bestimmungstabelle der philippinischen Trichalus-Arten.

1. Die gelben Elytren sind niemals quer verdunkelt, die dunklen Farbenpartieen liegen am Rande und an der Sutura und setzen sich auf den Prothorax fort.. **T. clypeatus sp. nov.**
   Die Dunkelfärbung trennt die hellen und dunklen Farbenkomplexe immer quer oder die Elytren sind ganz einfarbig schwarz.............................. 2.
2. Prothorax breit, drittes und viertes Fühlerglied stumpf gezähnt, dreieckig, Penis mit aufgeklapptem Präputium.................... **T. absonus sp. nov.**
   Prothorax quadratisch, drittes und viertes Fühlerglied länger als breit, nicht gezähnt, Präputium nicht aufgeklappt........... **T. costilis sp. nov.**

ILLUSTRATIONEN

TAFEL 1

FIG. 1 und 2. *Calochromus macropalpis* sp. nov.; 1, Mandibulartaster; 2, Penis.

3 bis 8. *Calochromus conveniens* sp. nov.; 3, Mandibulartaster; 4, Prothorax; 5 und 6, Verteilung der blauen Farben an der Elytrenbasis; 7, Penis von der Seite; 8, Penis von unten.

9. *Calochromus pallidulus* sp. nov., Mandibulartaster.

10 bis 12. *Lycostomus frivolus* sp. nov.; 10, drittes und viertes Fühlerglied; 11, Prothorax; 12, Penis.

13 und 14. *Lycostomus flavotestaceus* sp. nov.; 13, drittes bis fünftes Fühlerglied; 14, Penis.

15 bis 17. *Lycostomus pygmaeus* sp. nov.; 15, Prothorax; 16, Penis in Seitenansicht; 17, Penis in Aufsicht von unten.

18 und 19. *Plateros ordinarius* sp. nov.; 18, Prothorax; 19, Penis.

20. *Plateros contortus* sp. nov., Penis.

21. *Plateros senex* sp. nov., Penis.

22. *Plateros pilosus* sp. nov., Penis.

23 und 24. *Plateros luteolus* sp. nov.; 23, Prothorax; 24, Penis.

25 bis 27. *Plateros generalis* sp. nov.; 25, Prothorax; 26, mittlere Fühlerglieder; 27, Penis.

28 und 29. *Plateros lepidus* sp. nov.; 28, Penis in Seitenansicht; 29, Penis in Aufsicht von unten.

30 bis 32. *Plateros fucosus* sp. nov.; 30, mittlere Fühlerglieder; 31, Habitusbild; 32, Penis in Aufsicht von unten.

33 und 34. *Plateros cuneatus* sp. nov.; 33, Penis in Aufsicht von unten; 34, Penis in Seitenansicht.

35 und 36. *Plateros ponderosus* sp. nov.; 35, mittlere Fühlerglieder; 36, Penis.

37. *Plateros luzonicus* sp. nov., Penis.

38. *Plateros popularis* sp. nov., Penis.

39. *Plateros fulgidus* sp. nov., Penis.

40. *Plateros tenebrans* sp. nov., Penis.

41. *Plateros contrarius* sp. nov., Penis.

42. *Plateros simillimus* sp. nov., Penis.

TAFEL 2

FIG. 1. *Plateros triangulus* sp. nov., Penis.

2. *Plateros contextus* sp. nov., Penis.

3 und 4. *Plateros conspiciendus* sp. nov.; 3, mittlere Fühlerglieder; 4, Penis.

5 und 6. *Plateros testaceus* sp. nov.; 5, drittes und viertes Fühlerglied; 6, Penis.

FIG. 7. *Pateros conspicuus* sp. nov., Penis.
8. *Plateros bakeri* sp. nov., Penis.
9 und 10. *Plateros constans* sp. nov.; 9, Prothorax; 10, Penis.
11. *Plateros continens* sp. nov., Penis.
12. *Plateros fraudulentus* sp. nov., Penis.
13 bis 15. *Plateros quadraticollis* sp. nov.; 13, drittes bis fünftes Fühlerglied; 14, Prothorax; 15, Penis.
16. *Plateros contiguus* sp. nov., Penis.
17. *Plateros fraterculus* sp. nov., Penis.
18 bis 20. *Ditoneces philippinensis* Bourgeois; 18, männliches Fühlerglied; 19, weibliche Fühler; 20, Penis.
21. *Ditoneces afflictus* sp. nov., Penis.
22 und 23. *Ditoneces consociatus* sp. nov.; 22, männliches Fühlerglied; 23, Penis.
24 und 25. *Ditoneces consonus* sp. nov.; 24, Prothorax; 25, Penis.
26 bis 29. *Ditoneces affinis* sp. nov.; 26, männliches Fühlerglied; 27, Prothorax; 28, Penis in Seitenansicht; 29, Penis in Aufsicht.
30 bis 32. *Ditoneces alienus* sp. nov.; 30, mittleres Fühlerglied des Mannes; 31, Penis in Aufsicht; 32, Penis in Seitenansicht.
33 bis 35. *Ditoneces promiscuus* sp. nov.; 33, mittleres Fühlerglied des Mannes; 34, Farbenverteilung auf der Oberseite des Körpers; 35, Penis.
36 bis 39. *Ditoneces pusillus* Bourgeois; 36, weibliches Fühlerglied; 37, männliches Fühlerglied; 38, Penis in Aufsicht; 39, Penis in Seitenansicht.
40 bis 42. *Ditoneces aestimabilis* sp. nov.; 40, männliches Fühlerglied; 41, Prothorax; 42, Penis.
43. *Ditoneces conterminus* sp. nov., Penis.
44 und 45. *Ditoneces continuus* sp. nov.; 44, männliches Fühlerglied; 45, Penis.
46 und 47. *Ditoneces pilosicornis* Blanchard; 46, Prothorax; 47, Penis.
48 bis 50. *Ditoneces aemulus* sp. nov.; 48, mittleres männliches Fühlerglied; 49, Penis in Seitenansicht; 50, Penis in Aufsicht von unten.
51 und 52. *Subdihammatus curvus* sp. nov.; 51, erstes bis fünftes Fühlerglied; 52, Begattungsorgan in Seitenansicht.
53. *Dihammatus abditus* sp. nov., Prothorax.
54 und 55. *Dihammatus abjectus* sp. nov.; 54, Prothorax; 55, Penis.
56. *Dihammatus orientalis* sp. nov., Prothorax.
57. *Dihammatus pallens* Waterhouse, Penis.
58 bis 60. *Libnetis commendabilis* sp. nov.; 58, mittlere Fühlerglieder; 59, Prothorax; 60, Penis.
61 und 62. *Libnetis gracillimus* sp. nov.; 61, Prothorax; 62, Penis.

TAFEL 3

FIG. 1 bis 3. *Libnetis bardus* sp. nov.; 1, mittleres Fühlerglied; 2, Prothorax; 3, Penis.
4 bis 7. *Libnetis coloratus* sp. nov.; 4, Prothorax; 5, mittlere Fühlerglieder; 6, Penis in Aufsicht; 7, Penis von der Seite.

FIG. 8. *Libnetis defectus* sp. nov., Penis.
9 und 10. *Libnetis deductus* sp. nov.; 9, Prothorax; 10, Penis.
11. *Libnetis debilis* sp. nov., Penis.
12 bis 14. *Dilophotes abnormis* sp. nov.; 12, drittes und viertes Fühlerglied; 13, Penis; 14, Farbenvariationen.
15 bis 17. *Dilophotes comes* sp. nov.; 15, drittes und viertes Fühlerglied; 16, Penis in Aufsicht von oben; 17, Penis in Seitenansicht.
18 und 19. *Lyropaeus philippinensis* sp. nov.; 18, Farbenvariationen der Körperoberseite; 19, Penis.
20. *Metriorrhynchus philippinensis* Waterhouse, Penis.
21 bis 23. *Metriorrhynchus croceus* sp. nov.; 21, mittleres Fühlerglied; 22 und 23, Penis.
24. *Metriorrhynchus forcipatus* sp. nov., Penis.
25 und 26. *Metriorrhynchus böttcheri* sp. nov., Penis.
27 und 28. *Cladophorus fragilis* sp. nov.; 27, Prothorax; 28, Penis.
29. *Cautires coronarius* sp. nov., Penis.
30 und 31. *Cautires exploratus* sp. nov.; 30, Prothorax; 31, Penis.
32 und 33. *Bulenides aterrimus* sp. nov., Penis.
34 und 35. *Bulenides adumbratus* sp. nov., Penis.
36. *Bulenides adventicius* sp. nov., Penis.
37 und 38. *Bulenides parvulus* sp. nov.; 37, Penis in Seitenansicht; 38, Penis, Aufsicht von unten.
39 bis 41. *Xylobanus blandus* sp. nov.; 39, mittleres Fühlerglied; 40, Prothorax; 41, Penis in Seitenansicht.
42 bis 45. *Xylobanus benignus* sp. nov.; 42, mittleres Fühlerglied; 43, Prothorax; 44, Penis in Aufsicht; 45, Penis in Seitenansicht.
46 bis 48. *Xylobanus lanatus* sp. nov.; 46, mittleres Fühlerglied; 47, Prothorax; 48, Penis.
49. *Xylobanus nitidus* sp. nov., Prothorax.
50 und 51. *Xylobanus consimilis* sp. nov.; 50, mittleres Fühlerglied; 51, Penis.
52 und 53. *Xylobanus consobrinus* sp. nov.; 52, Prothorax; 53, Penis.
54 bis 57. *Xylobanus pubens* sp. nov.; 54, Penis; 55, viertes bis fünftes Fühlerglied; 56, Mandibulartaster; 57, Prothorax.

TAFEL 4

FIG. 1. *Xylobanus caelestis* sp. nov., Penis.
2 und 3. *Xylobanus barbarus* sp. nov.; 2, viertes und fünftes Fühlerglied; 3, Penis.
4 und 5. *Xylobanus canaliculatus* sp. nov.; 4, Elytrengitterung; 5, Penis.
6 bis 8. *Xylobanus brevis* sp. nov.; 6, mittleres Fühlerglied; 7, Prothoraxformen; 8, Penis.
9. *Xylobanus bellus* sp. nov. Penis.
10 bis 13. *Xylobanus quadratus* sp. nov.; 10 Prothorax; 11, Elytrengitterung; 12, Penis in Seitenansicht; 13, Skizze des Penis in Aufsicht von unten.
14. *Xylobanus basilensis* sp. nov., Prothorax.

FIG. 15 bis 18. *Xylobanus paululus* sp. nov.; 15, fünftes Fühlerglied; 16, Prothorax; 17, Elytrengitterung; 18, Penis.

19 bis 21. *Xylobanus candidus* sp. nov.; 19, viertes und fünftes Fühlerglied; 20, Prothorax; 21, Penis.

22 und 23. *Xylobanus pullatus* sp. nov.; 22, drittes bis viertes Fühlerglied; 23, Penis.

24 bis 26. *Xylobanus consentaneus* sp. nov.; 24, mittleres Fühlerglied; 25, Prothorax; 26, Penis.

27. *Xylobanus pudicus* sp. nov., Penis.

28 bis 30. *Xylobanus fragilis* sp. nov.; 28, Prothorax; 29, Penis in Aufsicht; 30, Penis in Seitenansicht.

31 und 32. *Xylobanus bicoloratus* sp. nov.; 31, mittleres Fühlerglied; 32, Penis.

33 und 34. *Xylobanus consociatus* sp. nov.; 33, mittleres Fühlerglied; 34, Prothorax.

35 bis 37. *Xylobanus luzonicus* sp. nov.; 35, drittes und viertes Fühlerglied; 36, Prothorax; 37, Penis.

38 und 39. *Metanoeus bakeri* sp. nov.; 38, Prothorax; 39, Penis.

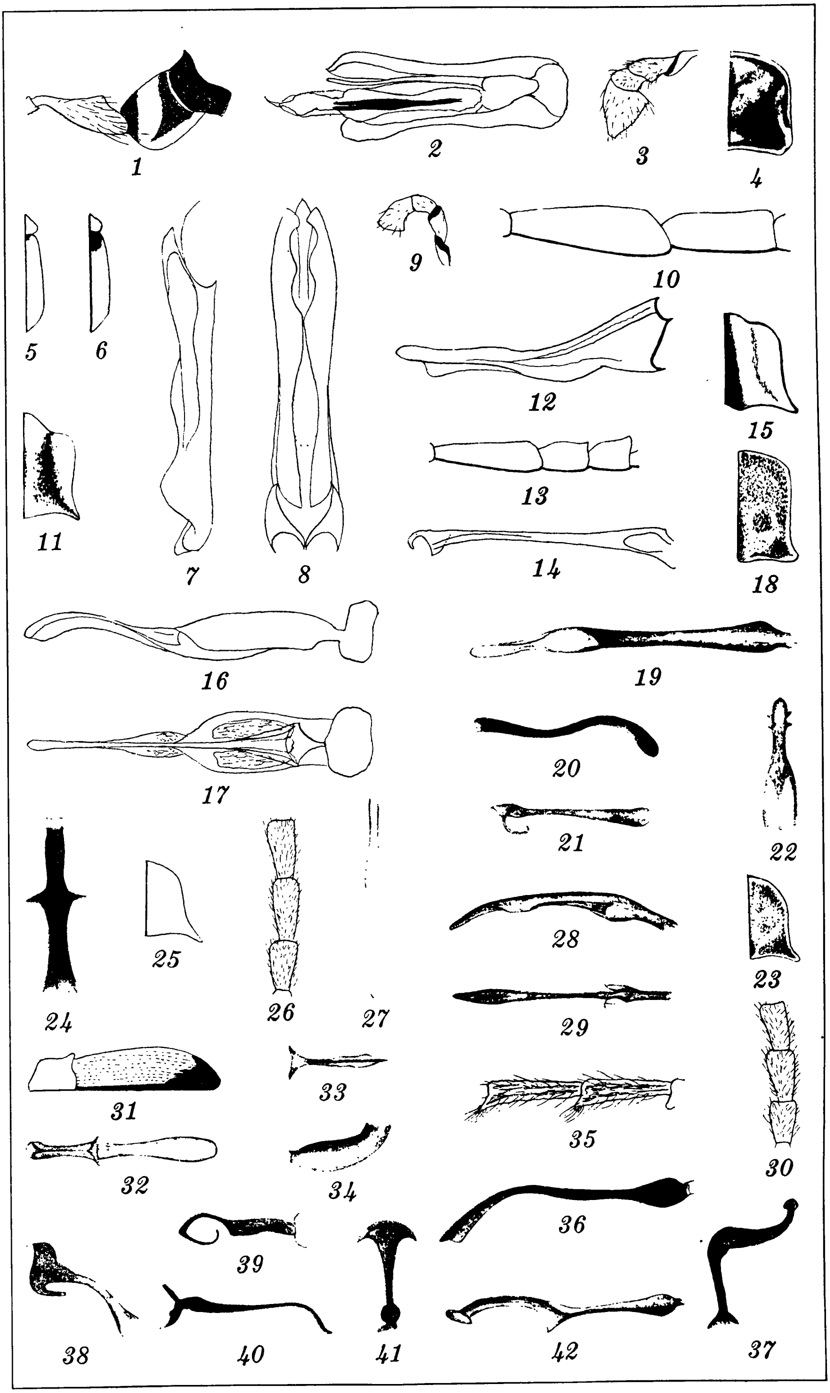
40. *Metanoeus cognatus* sp. nov., Penis.

41. *Leptotrichalus dispar* sp. nov., Penis.

42 bis 44. *Trichalus clypeatus* sp. nov.; 42, viertes und fünftes Fühlerglied; 43, Variationen der dunklen Partieen des Oberkörpers; 44, Penis.

45 und 46. *Trichalus absonus* sp. nov.; 45, Fühlerform; 46, Penis.

47 bis 49. *Trichalus costilis* sp. nov.; 47, Prothorax; 48, mittleres Fühlerglied; 49, Penis.



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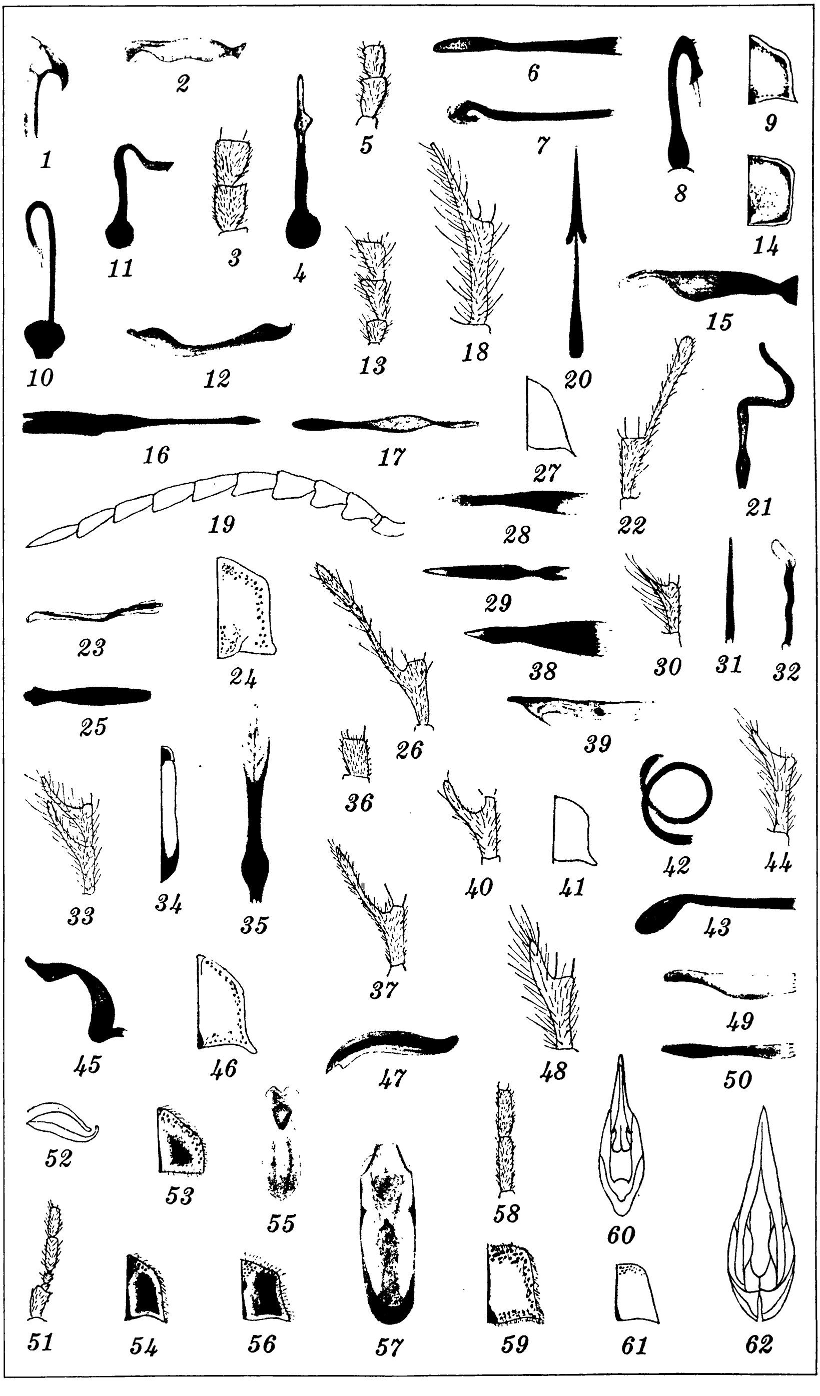

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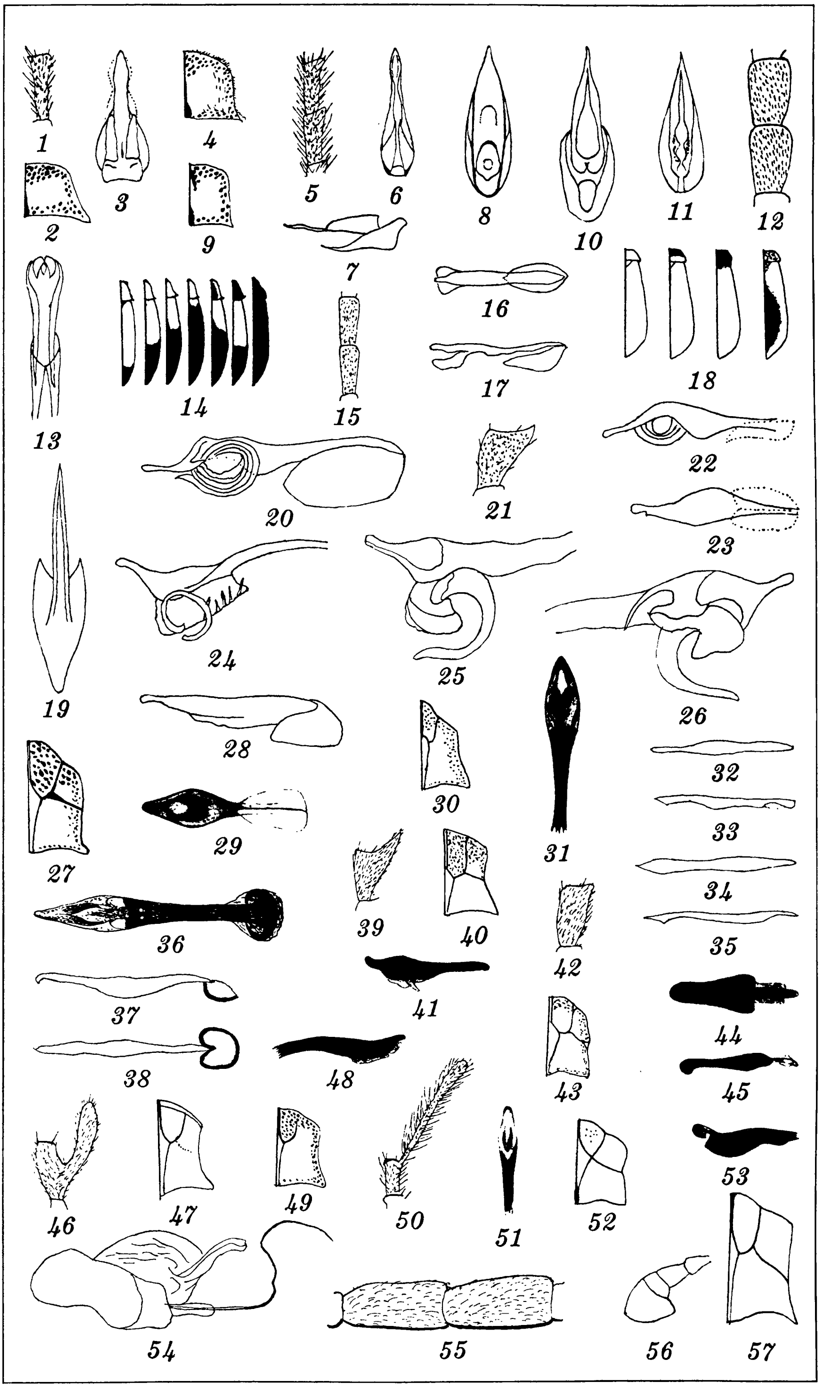

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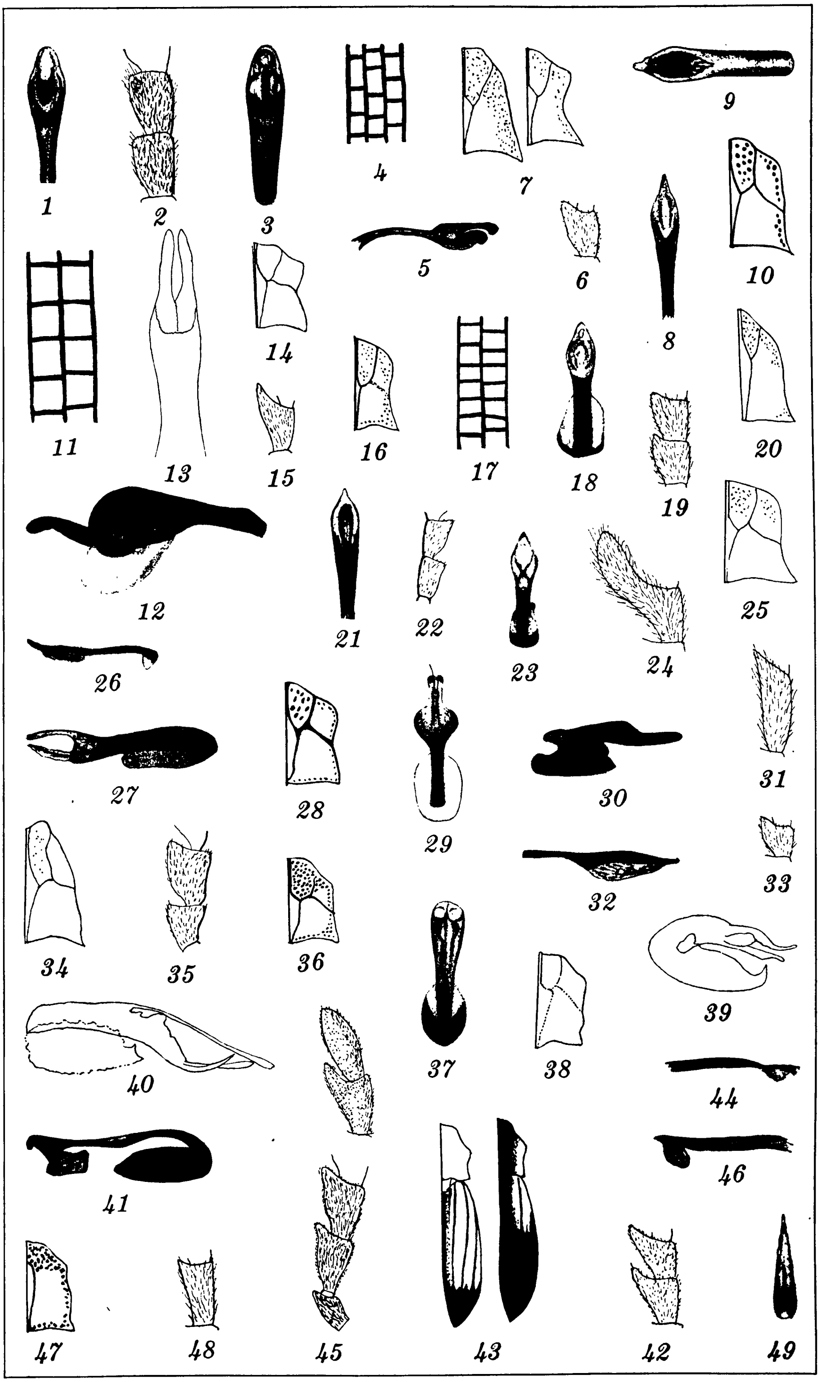

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STUDIES ON EARLY LEPROSY IN CHILDREN OF LEPERS

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THREE PLATES AND ONE TEXT FIGURE

I. INCIDENCE OF LEPROSY IN CHILDREN BORN OF LEPERS AT CULION

Leprosy has been handed down to us from ancient times as one of the most puzzling diseases known to science. Present-day knowledge concerning some of the most important features of this malady is still unsatisfactory. The incubation period, for instance, until very recently, was practically unknown, although the literature is cluttered with innumerable estimates that range from a few months to thirty or more years. What is certain concerning the methods of invasion and the portal of entry is likewise meager, and the question of the initial lesion is still sub judice. This condition of affairs is due to several factors, the most important of which are: (1) The incubation period is long and the development of the disease slow, compared with other infectious diseases; (2) it has not been possible so far to transmit the disease to experimental animals; and (3) it has heretofore been difficult to gather observations on a sufficiently large number of cases, showing the early symptoms of leprosy, to permit definite conclusions being drawn.

The children born at Culion of leper parents, some of whom have become lepers, offer an unusual opportunity for the study of the earliest manifestations of the disease. All of them have lived with their leprous parents for varying lengths of time, the majority continuously since birth.

An article by Gomez, Avellana Basa, and Nicolas, based on a study of three hundred eight of these children, created considerable interest on account of the unusually rich material presented. The present work, besides bringing their data up to date, takes up in addition certain details, which may not be lacking in interest on account of their direct bearing on the important problem stated above. It is well to state beforehand, however, that the findings should not be applied without reservation to leprosy as it appears in adults.

PRESENT STUDY

Since the establishment of the colony, in May, 1906, to December 31, 1924, eight hundred seventy-one children have been born at Culion, of whom three hundred ninety-eight have died, seventy-five have been sent away as nonlepers, and three hundred ninety-eight were still at Culion at the close of 1924. The data here presented were obtained from a survey of the children remaining at Culion by the end of 1924, as well as from the individual charts of both the children and their parents, from the records in the office of the chief of the Culion Leper Colony and the Negative Children's Home, and from personal interviews with the parents, if alive. Each child was thoroughly examined for suspicious manifestations, and smears from all suspicious blemishes were examined. Most of the bacteriological examinations done in connection with the present work were performed by Dr. F. Solis, of the pathological section of the colony.

Classification.—In their survey, Gomez, Avellana Basa, and Nicolas adopted the following classification of the Culion children:

Positive or confirmed lepers.—These show definite signs of leprosy such as macules, infiltrations, nodules, anæsthesia, etc., and the presence of *Mycobacterium leprae* is demonstrated either from the lesions themselves or from the nasal septum.

Clinical lepers.—This group includes those showing definite anæsthesia or multiple macular lesions and presenting palpable lymphatic glands, but in whom smears taken from the suspected lesions and from the septum are consistently negative for the specific organism.

Suspicious lepers.—These show suspicious manifestations, which usually consist of one or more macules differing in character and distribution from the common *Tinea alba,* and exhibiting doubtful anæsthetic changes. Another relatively common suspicious sign in the younger children is dryness and flushing of the skin at the pretibial region. One or both ulnar nerves are sometimes enlarged.

Nonlepers or negatives.—Children are so classified when entirely free from all suspicious manifestations of leprosy.

For the purposes of description the above classification has been followed in this report. It is my observation, however, that in several cases the suspicious macules are changeable and evanescent, so that a case classified at the first examination as suspicious may be found on reëxamination a few months later to have become negative, even without treatment. For example, of the fifty-eight cases classified as "suspicious" by Gomez, Avellana Basa, and Nicolas in 1922, twenty-four, or 41 per cent, had become negative by December 31, 1924, in spite of the fact that most of them had received no treatment whatever; only a few had treatment for two months. Fourteen (24 per cent) had become lepers, five (9 per cent) were found to be clinical lepers, fourteen (24 per cent) were still suspicious, and one (2 per cent) had died. Of the two hundred six cases found negative by the previous workers one hundred ninety-six were living; eighteen (9 per cent) of these, were clinical and bacteriological lepers, seventy (36 per cent) had become suspicious, and only ninety-nine (50 per cent) had remained negative.

Incidence.—The first survey of the children born at Culion was made by Denney in 1916, ten years after the establishment of the colony. At that time three hundred fifty-one babies had been born, of whom one hundred sixty had died, thirty-seven had been released at early ages, and one hundred fifty-four were still in the colony. He found sixteen of the latter (10 per cent) positive lepers.

At the examination made by Gomez, Avellana Basa, and Nicolas five years later, 7.8 per cent of the three hundred eight children then living were positive lepers, 6.4 per cent were clinical lepers, 18.8 per cent showed suspicious signs, and 66.8 per cent were nonlepers.

Of the three hundred ninety-eight children remaining in the colony by December 31, 1924, fifty-nine (14.8 per cent) were or had been positive lepers, eleven (2.8 per cent) were clinical lepers, ninety-seven (24.4 per cent) were suspicious, and the rest, two hundred thirty-one (58 per cent), were negative. In other words, 42 per cent were either lepers or had suspicious signs of leprosy.

Incidence of leprosy as to age and sex.—Table 1 gives the incidence of positive lepers, clinical lepers, and suspected lepers, according to age, in two-year periods, and sex.

TABLE 1.—*Incidence of leprosy as to age and sex.*

Age group.	Sex.	Positive lepers.		Clinical lepers.		Suspicious.		Negative.		Total.
		Cases.	Per cent.	Cases.	Per cent.	Cases.	Per cent.	Cases.	Per cent.	
Years.										
0 to 2	Male	1	1.7	0	0	3	5.3	52	93.0	56
	Female	1	2.4	0	0	4	9.8	36	87.8	41
2 to 4	Male	3	10.3	0	0	9	31.0	17	58.6	29
	Female	2	6.2	1	3.1	18	56.3	11	34.4	32
4 to 6	Male	3	8.6	0	0	15	42.8	17	48.5	35
	Female	5	17.2	2	6.9	11	38.0	11	38.0	29
6 to 8	Male	9	29.0	0	0	10	32.2	12	38.6	31
	Female	8	21.6	4	10.8	5	13.5	20	54.0	37
8 to 10	Male	6	25.0	1	4.3	7	29.1	10	41.6	24
	Female	4	12.9	1	3.2	8	25.8	18	58.0	31
10 to 12	Male	5	33.3	1	6.7	1	6.7	8	53.3	15
	Female	2	13.4	0	0	5	33.0	8	53.3	15
12 to 14	Male	3	42.8	1	14.3	0	0	3	42.8	7
	Female	4	50.0	0	0	0	0	4	50.0	8
14 to 16	Male	0	0	0	0	0	0	1	10.0	1
	Female	3	42.8	0	0	1	14.3	3	42.8	7
Total	Male	30	15.1	3	1.5	45	22.8	120	60.6	198
	Female	29	14.5	8	4.0	52	26.0	111	55.5	200

The sexes are about evenly represented, there being one hundred ninety-eight males and two hundred females. Thirty (15.1 per cent) of the males were confirmed lepers, while twenty-nine (14.8 per cent) of the females were found leprous. It is evident that the higher incidence of leprosy among adult males in the proportion of two to one over the females in Culion lepers is not apparent among these children.

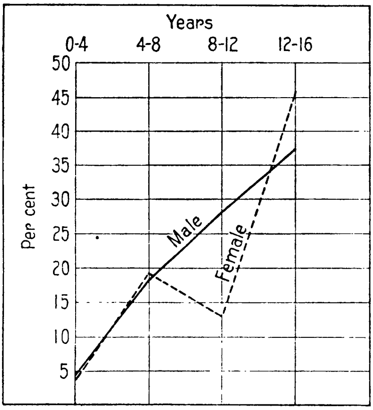

FIG. 1. Incidence of leprosy in male and in female children.

Although considerable differences are noted in some of the age groups there is no tendency for the incidence to vary in either sex from the youngest to the oldest children. If, however, the data shown in Table 1 are condensed and plotted, as in fig. 1, interesting differences between the two sexes will be noted among the older children.

The curve for males in fig. 1 shows a gradual rise with age; the female line, on the other hand, is more irregular. The incidence of leprosy is practically identical in both sexes up to the eighth year; after that age the incidence tends to follow the normal ratio between males and females in adults; namely, two to one (28 to 13 per cent in the 8-to-12-year age group). This is probably due to the fact that dissimilarity between the activities and habits of the girls and those of the boys begins to become pronounced at this period. Between the ages of 10 and 16 years, however, the influences of puberty, naturally more pronounced in girls, become manifest. The incidence among the females rises suddenly, exceeding the male figure by 10 per cent.

Rearranging the data shown in Table 1 so that the age is given in four-year periods, irrespective of the sex, Table 2 was obtained:

TABLE 2.—*Incidence of leprosy according to age, in four-year periods.*

Age.	Number in group.	Positive lepers.	
		Cases.	Per cent.
Years.			
0 to 4	158	7	4.4
4 to 8	132	25	19.0
8 to 12	85	17	20.0
12 to 16	23	10	43.5
Total	398	59	14.8

The incidence is found to increase with age. Only 4.4 per cent of the children below 4 years of age were found leprous, while among the twenty-three remaining children, between 12 and 16 years old, 43.5 per cent were already confirmed lepers. These findings are in line with the observation of Hollmann,[1] who found that, in the case of the children of lepers at the Molokai Settlement, the longer the exposure of the children to their leprous parents the higher the incidence of leprosy, a condition entirely to be expected.

Age at appearance of leprosy.—Table 3 shows the age at which the first suspicious lesions in the clinically positive and the suspicious cases appeared.

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[1] U. S. Public Health Bull. 39 (1910).

TABLE 3.—*Age of appearance of suspicious lesion.*

Age at onset.	Clinical lepers.		Suspicious.	
	Cases.	Per cent.	Cases.	Per cent.
Years.				
0 to 1	1	9.1	10	10.3
1 to 2	0	0	10	10.3
2 to 3	0	0	12	12.4
3 to 4	2	18.2	14	14.4
4 to 5	2	18.2	8	8.2
5 to 6	1	9.1	8	8.2
6 to 7	2	18.2	6	6.2
7 to 8	1	9.1	3	3.1
8 to 9	0	0	4	4.1
9 to 10	0	0	4	4.1
10 to 11	0	0	0	0
11 to 12	0	0	0	0
12 to 13	0	0	1	1.0
No data	2	18.2	17	17.5

In 33 per cent of the suspicious children, the first suspicious lesion was noticed during the first three years. Among the clinically positive cases only 9.1 per cent showed the first lesion during this period; in 45 per cent it was observed between the third and the sixth years.

The ages at which the lesions were found bacteriologically positive in the group of confirmed lepers are given in Table 4.

TABLE 4.—*Age of children when found positive bacteriologically.*

Age.	Positive lepers.		Age.	Positive lepers.	
	Cases.	Per cent.		Cases.	Per cent.
Years.			*Years.*		
0 to 1	0	0	7 to 8	1	1.7
1 to 2	2	3.4	8 to 9	2	3.4
2 to 3	8	13.5	9 to 10	4	6.8
3 to 4	9	15.3	10 to 11	1	1.7
4 to 5	10	16.9	11 to 12	2	3.4
5 to 6	11	18.6	12 to 13	1	1.7
6 to 7	7	11.9	No data	1	1.7

Fifty per cent of the confirmed lepers were found positive between the ages of 3 and 6 years. The average age at which the confirmed lepers became bacteriologically positive was 5 years 9 months. There is no doubt that in many of these cases the lesions were actually positive for some time before the bacteriological examinations were made. Taking also the period of incubation into consideration it is evident that infection had taken place at a very early age. This matter will be discussed more fully later.

In fifteen cases it has been possible to make repeated bacteriological examinations from the initial suspicious lesions until they became positive. In two children the first lesion was found positive within a week after it was noticed. The longest period observed in the others was thirteen months; the average was five months.

The youngest leper seen was a girl who was found bacteriologically positive at the age of 18 months. The initial macular lesion was first seen at the age of 8 months, and repeated bacteriological examinations from it were negative until ten months later. The next youngest was also a girl, 22 months old, on whom the initial lesion was first noticed five months before becoming positive microscopically.

CONCLUSIONS

1. Of the three hundred ninety-eight children of leprous parents living in the Culion Leper Colony on December 31, 1924, fifty-nine (14.8 per cent) were bacteriologically positive, or had been positive lepers; eleven (2.8 per cent) were clinical lepers but negative bacteriologically; ninety-seven (24.4 per cent) had suspicious manifestations, and two hundred thirty-one (58 per cent) were nonleprous.
2. The incidence of leprosy among these children increased with the length of the period of exposure; both sexes were about equally affected at the same age.
3. Fifty per cent of the confirmed lepers became positive between the ages of 3 and 6 years, the average age at the time they were found positive being 5 years 9 months.

II. FACTORS INFLUENCING TRANSMISSION DURING INTRAUTERINE LIFE

Heredity.—The discovery of the specific organism by Hansen in 1874 has definitely thrown into the discard the theory of hereditary transmission of leprosy. In the strict biological sense, a bacterial or parasitic disease cannot be so transmitted. However, several of the older authorities, among them Virchow, Van Dyke, and Carter and Levering [2] have claimed that, as is believed by some to be the case in tuberculosis, a predisposition to leprosy may be passed on by leprous progenitors to their offspring. This belief is based on the assumption that some organs or tissues of the body lack powers of resistance to the particular disease and that the defect is transmitted by heredity. A few writers have presented a large mass of data purporting to support this view, but their conclusions are largely negatived by the fact that the possibility of contagion cannot be eliminated in their cases.

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[2] All cited in the Report of the Leprosy Commission to India, Calcutta. Government of India General Printing Office (1892) 224–225.

As leprosy is present in either one or both of the parents of the children here reported, it is natural to presume that a taint in direct line exists in every case. It has been pointed out by Leloir however that, if the family taint is to be considered as a legitimate etiological factor in the transmission of a disease or its predisposition, it is necessary to ascertain whether the parent or parents were in a diseased condition at the time the child was born. For this reason, two children, born before the parents of either had developed leprosy, have been excluded in the following discussion. Outside of these two exceptions, one, or more frequently both, of the parents were leprous at the time of the birth of the child.

In order to determine the possible influence of a strongly positive history of leprosy in the family of the parents on the incidence of leprosy among their offspring, data on this point have been obtained, which are shown in Table 5. In the majority of the cases it was possible to trace the occurrence of the disease back to the parents' grandparents, so that four generations are included. The element of contagion may be disregarded in this connection, as all of these children have been exposed to the disease.

TABLE 5.—*Incidence of leprosy in relation to the existence of a positive history of leprosy in the parents.*[a]

History of leprosy in parents.	Cases.	Condition of offspring.							
		Lepers.		Clinical lepers.		Suspicious.		Negative.	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Negative	84	11	13.1	1	1.2	31	36.9	41	48.9
Taint in direct line	102	12	11.8	5	4.9	28	27.4	57	55.9
Taint in collateral line	99	14	14.1	2	2.0	37	37.4	46	46.5

[a] The diagnoses of leprosy reported in the family are in the large majority of our cases accurate, as most of the cases have been admitted to the Culion Leper Colony.

From Table 5 it would seem that the existence of a positive family history in either one or both of the parents does not necessarily favor the development of leprosy among their offspring. In other words, no greater predisposition to leprosy was observed among children of persons coming from families with distinct history of leprosy than among children of parents without a taint in their family. Twelve per cent of the children of lepers with distinct family taint have become leprous, while 13 per cent of those neither of whose parents had leper ancestors or relatives were found positive.

Taking the fathers and the mothers separately, however, an interesting difference is brought out, as can be seen in Table 6. The suspicious and negative cases have been omitted.

TABLE 6.—*Incidence of leprosy among Culion children in relation to the family history of the father and the mother.*[a]

Family history.	Cases.		Confirmed and clinical lepers among the children.	
	Number.	Per cent.	Number.	Per cent.
Father:				
Negative for leprosy	175	68.5	29	16.5
Taint in direct line	39	15.3	4	10.2
Taint in collateral line	41	16.1	6	14.6
Mother:				
Negative for leprosy	115	42.8	13	11.3
Taint in direct line	77	28.7	16	20.8
Taint in collateral line	76	28.4	14	18.4

[a] Data on thirteen fathers who were nonlepers could not be obtained.

With reference to the fathers, 16.5 per cent of the children of those with negative family history have become lepers, while only 10.2 per cent of the children of fathers with family taint in direct line were leprous. On the other hand, the incidence of leprosy in the children of mothers with leprous family taint is considerably higher than among those who did not show a taint (20.8 per cent and 11.3 per cent, respectively).

It is also to be noted that, while only 15.3 per cent of the fathers show a family taint in direct line and 16.1 per cent in collateral lines, the corresponding figures for the mothers are 28.7 and 28.4 per cent, respectively. It would seem then that the transmission of a predisposition, if it exists at all, is stronger in the female than in the male. This observation is further strengthened by the finding that, of the thirty-nine female children of mothers showing taint in direct line, 30.8 per cent had become confirmed and clinical lepers, whereas only 13.1 per cent of the thirty-eight male children of the same mothers were found to be leprous. On the other hand, of fifty-eight female children of mothers with negative family histories, only 12 per cent were found leprous, whereas 18.6 per cent of the male children had leprosy. It is of interest to note that the Leprosy Commission to India[3] obtained an incidence of only 4 per cent of family taint in direct line, and accepted Van Dyke's figure of 14.5 per cent in collateral lines among Indian lepers.

Summarizing, it may be stated that the data given above neither prove nor disprove conclusively the possibility of transmission of a predisposition. I believe that the statement of Fishberg[4] with regard to the same problem in tuberculosis can be applied as well, mutatis mutandis, to leprosy. This author says:

> Statistical proof of the hereditary transmission of tuberculosis, or a predisposition to it, will only be satisfactory when careful records of many patients are kept for several generations in which children of tuberculous parentage have succumbed to the disease despite the fact that they have been removed immediately after birth. To be of scientific value they should be based on detailed postmortem examinations of parents and grandparents, and even of collaterals. Such data we do not have.

However, we are justified in stating that, if transmission of a predisposition is possible at all, it plays a minor rôle in the dissemination of leprosy.

Placental transmission.—Transmission through intrauvular and spermatogenic infection is of no practical importance, and this possibility may be disregarded. It is a well-known fact, however, that many diseases, such as smallpox, syphilis, etc., may be transmitted from the mother during pregnancy to the fœtus through the placental circulation. In view of the frequent finding of lepra bacilli in the blood of lepers, this possibility has to be considered.

With regard to the literature on this very interesting subject only the abstracts of two articles are available to me. Sugai and Monobe,[5] besides finding the bacilli in four out of twelve placentas of leper mothers and lepra cells in six others, were able to demonstrate the presence of the organism in ten out of twelve newly born babies, and in the blood of a 17-month-old child of an infected mother. D. San Juan[6] has also found acid-fast bacilli in globi form in the placenta of lepers.

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[3] Report of the Leprosy Commission to India, Calcutta. Government of India General Printing Office (1892) 224–225.

[4] Pulmonary Tuberculosis. Lea & Febiger, Philadelphia (1924) 103.

[5] Sei-i-kwai Med. Journ. 32 (1913) 102–103. [Orig. Journ. Tok. Med. Assoc. 27 (1913) 8. Abst. Trop. Dis. Bull. 2 (1913) 281–282.]

In connection with the present work, the placenta and umbilical cord were examined for gross pathological changes and for the presence of *Mycobacterium leprae.* In fifteen specimens examined four (26.6 per cent) were found positive for *M. leprae* in the cord at its fœtal end, twice in globi form; only in one of these were the bacilli found also in a smear taken deep in the placental tissue. This phase of the work has been continued by Dr. E. V. Pineda, of the pathological section, who, using a much improved technic, has been able to obtain positive results with considerably greater frequency.

It is evident that the bacilli reach the fœtus through the placental circulation in a considerable proportion of the cases. This is undoubtedly particularly apt to occur when the mother develops during pregnancy the so-called "lepra fever," a condition which is often accompanied by bacteremia.

In this connection, the following observations seem significant. Of nineteen children of mothers having lepra fever during pregnancy, three (16 per cent) have become lepers, while only five (5 per cent) of one hundred children, of mothers who did not have such exacerbations, developed the disease. A dissimilarity in the size of the two groups exists, but the results are suggestive. Furthermore, the average age at onset in the three positive children of "lepra fever" cases was 2 years 11 months, one year less than the average age at onset in the five leprous children of mothers without lepra fever. As the age at which the disease appeared in these three children is well under the estimated incubation period in children, it is possible that the infection was transmitted through the placental circulation, though no manifestations were apparent at birth.

What finally happens to the bacilli after reaching the fœtal circulation cannot, in the light of our present knowledge, be ascertained. The fact remains that experience in Hawaii[7] and in India[8] has shown that, if the children of lepers are segregated immediately after birth, only a negligible percentage develop the disease. Two possiblilities suggest themselves, as follows:

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[6] Rev. Argentina de Obst. y Ginecol. 1 (1919). Abst. Rev. de Med. y Farm., Manila 10 (1919) 439.

[7] Hasseltine, U. S. Public Health Bull. 141.

[8] Jackson, In Leper Land. Marshall Brothers, London (1901) 108.

1. The organism may remain dormant in some organ, such as the lymph nodes, spleen, nerves, etc., to flare up and multiply when for some reason or other the natural resistance of the body fails.

2. The tissues of the fœtus and young infant may, with comparative efficiency, be able to dispose of the organisms so that, though organisms frequently reach them, infection infrequently ensues, as suggested by Dr. H. W. Wade, chief pathologist of the Culion Leper Colony. It is possible that in this manner a certain degree of immunity, lasting for a longer or a shorter time, may be conferred upon the child.

We cannot present any data at present to prove or disprove either of these theories. The fact remains that certain children are more susceptible than others and many apparently remain free from the disease, in spite of the most intimate contact with infective cases.

Congenital leprosy is unquestionably rare. I have not seen a single case among the one hundred sixty newborn children that I have examined so far. Currie[9] reports that in the literature of twenty-five years previous to 1915, only fourteen claims for prenatal infection have been made. I have, however, seen six cases in whom the suspicious lesions appeared between the third and the sixth months. Three of these lesions later became positive bacteriologically between the second and the third years.

Neither was there observed a higher incidence of congenital debility among the Culion children than among children born of Filipino nonleper parents. I believe that, if such a condition has been observed at Culion and other leprosaria in the past, it was due to the poor surroundings and misery suffered by the parents rather than to any effect of the disease per se.

The death rate among children less than 1 year old and the percentage of those dying of congenital debility among the children of leper parentage at Culion have consistently diminished, with the improvement in the care of the lepers in the colony.

Conditions at Culion were so poor in 1906 and 1907 that none of the children born during those years reached the age of 2 years. Of all the children born in the colony since its establishment, in May, 1906, to December 31, 1921, 42 per cent died within the first year after birth. According to Gomez et al., this was about the same as the corresponding rate for the City of Manila during the same period.

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[9] Am. Journ. Trop. Dis. & Prev. Med. 3 (1915–1916) 91.

With the generalization of the antileprotic treatment and the careful attention given to children born in the colony, made possible by the considerable increase in the medical and nursing staff early in 1922, the infant mortality has shown a marked reduction.

In the period of two years between January, 1922, and December 31, 1923, there were one hundred twenty-eight births of leprous parentage at Culion. Of this number, thirty (23 per cent) died below the age of 1 year. The corresponding figures for the City of Manila, for 1922 and 1923 together, was 19.3 per cent. The difference is not at all marked, considering the difference between the living conditions at Manila and those at Culion.

The above figures disprove the existence of congenital weakness due to leprosy in the parents. The infant mortality among the offspring of lepers diminishes as better care is given to the parents and to the children themselves.

Treatment of mothers during pregnancy.—In two hundred forty-two cases it has been possible to obtain data on the influence of the treatment of the mother, before and during pregnancy, with the chaulmoogra-oil derivatives. Of these, one hundred eighty-four received treatment at the time of conception and during pregnancy, while fifty-eight had none. The incidence of leprosy among their offspring is given in Table 7.

TABLE 7.—*Incidence of leprosy among children of treated and untreated mothers (during pregnancy).*

Care of mother during pregnancy.	Cases.	Lepers.		Clinical lepers.		Suspicious.		Negative.	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Treated	184	27	14.7	7	3.8	37	31.0	93	50.5
Untreated	58	6	10.4	2	3.4	21	36.2	29	50.0

In both groups about 50 per cent of the children have remained free from all traces of the disease so far. Although a proportionately lower percentage of the offspring of the untreated mothers have become lepers, there are relatively more suspicious cases in this group. At any rate, the difference between the two groups is not marked; it is evident that treatment of the mothers with the chaulmoogra derivatives does not diminish the incidence of leprosy in their offspring.

CONCLUSIONS

1. Hereditary transmission of a predisposition to leprosy is difficult to prove. The data presented in the present study indicate that, if such a possibility exists at all, it plays a minor rôle in the spread of the disease.

2. The lepra bacillus present in the tissues of a leprous mother reaches the fœtal circulation in a considerable percentage of cases, but the evidence is conclusive that transmission by this route very rarely takes place.

3. No congenital case of leprosy was seen or reported in the eight hundred seventy-one children born at Culion up to 1924. The earliest suspicious lesions were seen at the age of 3 months.

4. Leprosy in the parents does not give rise per se to an increased incidence of congenital debility in the offspring.

5. Treatment of leper mothers during pregnancy does not diminish the incidence of leprosy among their offspring.

III. FACTORS INFLUENCING TRANSMISSION DURING INFANCY AND EARLY CHILDHOOD

Possibility of transmission through the mother's milk.—The question of the possibility of transmission through the mother's milk needs to be investigated in view of the reported frequent involvement of the breast in lepers. Furthermore, Sugai and Monobe[10] have reported that they found *Mycobacterium leprae* in the milk of leper mothers in two out of ten cases. However, our experience at Culion is at variance with this. In not one of forty-five specimens examined by Doctor Solis was it possible to demonstrate the presence of *M. leprae*. The milk was centrifuged, and smears were taken from the cream as well as from the sediment.

Though most of the children born and brought up at Culion were breast fed, a considerable number have been either entirely bottle fed since birth or have received mixed feeding. Opportunity is thus given for the comparison of the influence of the manner of feeding on the incidence of leprosy among these children.

Of one hundred thirty-eight breast-fed children, 11.6 per cent were found to have become leprous; among sixty-five children who received mixed feeding, 16.9 per cent were lepers, while fully 24 per cent of fifty-four exclusively bottle-fed children were leprous. The incidence of leprosy among the bottle-fed children is twice that in breast-fed children.

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[10] Abst. Trop. Dis. Bull. 1 (1916) 566.

The mother's milk does not therefore seem to be an important vehicle of transmission in leprosy. The breast-fed children were as a rule found in better general condition; bottle feeding as practiced by the mothers at Culion resulted in weak and undernourished children, on the whole. This explains the difference in the incidence of leprosy in the two contrasting groups; the strong and better-nourished breast-fed children were more able to fight off the infection. It is thus once more shown that the better the health of the child exposed to leprosy the less its chance of acquiring the infection.

In my experience as member of the committee which examines the negative candidates in this colony, and in examining the breasts of leprous mothers, my attention has been drawn to a peculiar finding which I have not seen reported in the literature. While involvement of the nipples is quite commonly seen in middle-aged leprous women who have not given birth, it is very rarely found in women of the same age and in the same stage who have become mothers. In other words, most of the leprous women with infiltrated nipples are sterile. Further, involvement of the nipple is more frequently observed in males than in females.

Importance of skin diseases as portals of entry.—Gomez, Avellana Basa, and Nicolas remarked on the frequency of skin diseases in the Culion children. I have endeavored to secure more definite data on this point.

Of three hundred thirty-four children over 1 year of age examined, only twenty-three were definitely known to have had no skin disease of any kind. Of these, four (17.4 per cent) were lepers, one (4.5 per cent) was a clinical leper, five (21.8 per cent) were suspicious, and thirteen (56.5 per cent) were negative.

Of the rest, three hundred eleven in number, seven had had ordinary eczema, one of whom had become a leper; one had had yaws and was a suspicious leper; one hundred seventy-eight had had scabies, twenty-four (13.5 per cent) of whom were lepers. In one hundred twenty-five cases no definite data as to incidence of skin diseases could be obtained.

Although the number of children who had had no skin disease was too small to form an entirely satisfactory basis for comparison with those who had had skin diseases, it would seem that, contrary to common belief, skin diseases as a whole do not predispose to infection.

If scabies, which was the most frequent skin disease encountered, played an important rôle in the transmission of leprosy, there would not only be a higher incidence of leprosy among children who had had scabies than among the clean children, but comparatively more of those who had had the itch for a longer time would show leprosy.

Table 8 shows the incidence of leprosy among the children who had had scabies, based on the duration of the skin affection.

TABLE 8.—*Relation of duration of scabies to incidence of leprosy.*

Duration of scabies.	Total cases.	Cases becoming lepers.	
		Number.	Per cent.
Months.			
0 to 2	67	10	14.9
2 to 4	60	9	15.0
4 to 6	0	0	0
6 to 8	6	0	0
8 to 10	0	0	0
10 to 12	37	4	10.8
Over 1 year	8	1	12.5

Although the groups are not entirely comparable, due to differences in numbers, it is seen that, while the average incidence up to four months' duration is about 15 per cent, the corresponding figure for ten months upward is only 11 per cent. These figures confirm the preceding observation that scabies does not necessarily predispose to infection with leprosy. As for other skin diseases, we do not possess sufficient data to prove or disprove either side of the question.

However, it should not be concluded that infection cannot take place through a scabies itch. In fact, I have seen three cases in which the portal of entry was very evidently a scabies itch, as the first visible lesion was a macule surrounding an old scabies scar and growing concentrically from it. The macules of two of these cases were later found positive for *Mycobacterium leprae*.

Plate 1, fig. 1, shows the initial lesion of one of the two positive cases. A fresh macule developing from another scabies scar is also to be seen.

One other case was seen in which the first suspicious macule was seen in the middle of a triangular skin area at the back of the thigh, formed by three scabies scars, about an inch apart. I have not seen a suspicious lesion surrounding an active scabies itch.

The data here presented seem to prove that, although infection undoubtedly takes place with the scabies itch as the portal of entry, this skin disease as a rule does not predispose to infection.

It is not possible to state just how infection takes place through the lesions produced by *Acarus scabiei* when this occurs. Whether the raw surface affords an entrance for the bacilli, or whether the mite itself is responsible for its introduction, remains to be established. Why the presence of scabies does not generally favor infection, as might be expected, is not evident; possibly the inflammatory reaction resulting from the irritation favors the disposal of any bacilli that may gain entrance. Or, if the mite is the transmitting agent, it may not ordinarily carry a sufficient number of the organisms to produce an infection. When the itch is located directly on a recent infiltrated patch rich in bacilli, however, the mites may become the bearers of a sufficiently large number of bacilli to determine an infection in a new host.

Effect of leprosy in the parents.—Sand[11] has reported the most extensive data on this particular subject. He investigated five hundred twelve marriages in which one or both parents were lepers. He found one thousand six hundred fifty-five (93.4 per cent) sound and one hundred seventeen (6.6 per cent) leprous children issuing from these marriages. Lie[12] also investigated four hundred eighty-one marriages. The data of these investigations are here presented in tabular form (Table 9) compared with similar figures obtained at Culion.

TABLE 9.—*Incidence of leprosy in children of nonleper and of leper parents.*

Parents.	Sand.		Lie.		Rodriguez.	
	Marriages.	Incidence of leprosy.	Marriages.	Incidence of leprosy.	Marriages.	Incidence of leprosy.
		Per cent.		*Per cent.*		*Per cent.*
Father leper, mother nonleper	356	4.9	....	10.27	0	0
Mother leper, father nonleper	138	10.5	....	16.39	23	14.3
Father and mother both leprous	17	12.7	....	39.19	245	15.8

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[11] Lepra 12 (1911–1912) 39–46.

[12] Dermat. Wochenschrift 66 (1918) 1–14.

It is to be expected that, when the mother is a leper and the father is healthy, the incidence of the disease in the children is larger than when the father alone is infected. In fact, Sand asserts that it is striking that the difference is not twice as great as is actually shown in his cases. We have no data on the children issuing from marriages in which the husband alone had leprosy. In the other two groups, our figures, when the mother alone is a leper (14.3 per cent) and when both parents have the disease (15.8), are comparable with Sand's (10.5 and 12.7 per cent, respectively) and are considerably lower than Lie's (16.39 and 39.19 per cent).

Table 10 shows the influence of the type and advancement of the mothers' leprosy on the incidence of leprosy among their offspring in Culion lepers.

TABLE 10.—*Relation of type and advancement of leprosy in the mother to the incidence of leprosy in the children.*

Type and advancement of leprosy in mothers.	Cases.	Incidence of leprosy in children.	
		Number.	Per cent.
Type:			
Cutaneous	34	12	35.3
Mixed	185	25	13.5
Neural	33	3	9.1
Advancement:			
Slight	52	12	23.1
Moderate	166	20	12.0
Advanced	34	8	23.6

No data were obtained on thirty-six mothers who died previous to the present survey and whose records are missing. The incidence of leprosy is highest (35.3 per cent) among the children in contact with mothers with cutaneous leprosy, which is considered the most contagious type. In the case of mothers with the mixed type 13.5 per cent of the children became lepers, while in the case of those with neural leprosy only 9.1 per cent of the offspring became lepers.

Advancement does not seem to play an important rôle, the different stages being apparently equally infectious.

As regards the fathers, the effect of the type and advancement of the disease is seen in Table 11.

TABLE 11.—*Relation of type and advancement of leprosy in the father to the incidence of leprosy in the offspring.*[a]

Type and advancement of leprosy in fathers.	Cases.	Incidence of leprosy in children.	
		Number.	Per cent.
Type:			
Cutaneous	40	10	25.0
Mixed	136	20	14.7
Neural	32	5	15.6
Advancement:			
Slight	58	12	20.7
Moderate	123	18	14.6
Advanced	27	5	18.5

[a] In thirty-seven cases, the fathers could not be traced. Naturally, the data on the twenty-three nonleprous fathers do not appear in this table.

Although the difference is less marked than in the case of the mothers there is also a higher incidence of leprosy in the offspring of leper fathers with the cutaneous type than in children of fathers with mixed or anæsthetic leprosy.

Table 12 shows Sand's figures on the effects of the type of leprosy in the parents on the incidence of leprosy among their offspring, compared with the corresponding data obtained from Tables 10 and 11.

TABLE 12.—*Influence of type of leprosy in parents on incidence of leprosy in offspring.*

Type of disease.	Incidence of leprosy in children of lepers.		Type of disease.	Incidence of leprosy in children of lepers.	
	Rodriguez.	Sand.		Rodriguez.	Sand.
Mother:	*Per cent.*	*Per cent.*	Father:	*Per cent.*	*Per cent.*
Cutaneous	35.3	13.4	Cutaneous	25.0	6.6
Mixed	13.5	---------	Mixed	14.7	--------
Neural	9.1	5.2	Neural	15.6	1.3

In Sand's, as well as in the Culion cases, there is a higher incidence of leprosy in the offspring of lepers with cutaneous leprosy than among the children of those with the neural type, the difference being especially marked in the case of the mothers. More children among the Culion cases have become lepers under each type than among Sand's cases.

CONCLUSIONS

1. Breast feeding is not an important factor in the transmission of leprosy from mother to child.

2. Although in some cases the itch of scabies undoubtedly serves as the portal of entry in leper children, scabies and other skin diseases do not, in general, predispose to infection with leprosy. I have actually found a higher incidence of leprosy among children who have had no skin disease than among those who have had such disease.

3. As the leper parents, particularly the mothers, are in more intimate contact with their children than is any other person, they are chiefly responsible for infecting their own offspring. When the type of the leprosy in the parents is the neural, fewer children become infected than when it is the more-contagious cutaneous or mixed type.

IV. THE INITIAL LESION

Several writers on leprosy, among them Gomez,[13] believe that an initial primary lesion does not necessarily exist in this disease. Those holding this view contend that in many instances the invading microörganisms produce no appreciable lesion at the point of entrance and that, after having gained a foothold in the body, they may remain latent for a varying length of time. When conditions become propitious for their growth, the microorganisms multiply and the disease manifests itself.

The investigations of Sorel[14] and of Leboeuf,[15] in regard to the presence of acid-fast bacilli in the lymphatic glands of apparently normal individuals who have lived with lepers, serve to confirm this belief. Sorel found the bacilli in an inguinal gland in one out of fifteen persons living in close contact with lepers, while Leboeuf also found one such case out of five individuals cohabiting with lepers. These findings point to the lymphatic glands as the reservoir wherein the bacilli may lie immured during their inactive state in the body.

The above observations are based mostly on experience in adults. Gomez has made a study of the Culion children, but he was undoubtedly more influenced in his final conclusion by his findings among the inmates of the San Lazaro Hospital, who were mostly adults.

[13] Journ. Phil. Is. Med. Assoc. 3 (1923) 227–229.

[14] Bull. Soc. Path. Exot. (1912) 698.

[15] Ibid., 569.

As a result of my own observations among Culion children, I am inclined to believe that a primary lesion was present in the majority of those children (75 per cent) who have become definitely leprous. This belief is based on the following facts:

1. The three cases on whom the first lesion seen was a gradually enlarging macule starting from a scabies scar (mentioned in Part III of the present study) would seem to prove that a scabies itch may be the portal of entry and that a definite primary lesion existed at this site.
2. In seven other cases it has been possible to show that the initial lesion appeared just where a discharging nodule or a much-infiltrated skin on the forearm of the mother came in direct contact with the body of the child when she was carrying it. Incidentally, these seven cases would also seem to indicate that the irritation produced by the scratching of the child is enough so to affect such changes in the skin as to permit the entrance of the invading organisms.
3. The initial lesion was never seen in certain parts of the body that are frequently the sites of leprotic lesions in the more-advanced stages of the disease—such, for example, as the chest and the abdomen. Although certain places of predilection may be expected, such regions would not be entirely free if the first visible lesions were produced by the dissemination of the microörganisms through the blood and the lymphatic systems.
4. In the cases where an initial lesion was found to have been present, such lesion was the only one seen for a considerable period of time.

It is assumed that from the initial lesion, involvement of the peripheral nerves, the lymph nodes, and the other organs takes places more or less rapidly, so that the infection does not remain localized for long.

Location of the initial lesion.—Gomez, Avellana Basa, and Nicolas,[16] in their study on Culion children, found that the skin, rather than the nasal septum, was frequently the site of the initial lesion. In the twenty-four confirmed lepers found by them, all were positive bacteriologically on the skin; in only thirteen were the bacilli found also in the nasal septum. In not a single case did they find *Mycobacterium leprae* in the nasal septum without a positive lesion on the skin.

In the present survey, it has not been possible to examine the nasal septum in all the cases for *M. leprae*. Ten months later bacteriological examination of the nasal septum (combined with similar examinations from all suspicious cutaneous lesions) of two hundred fifty of these children above 3 years of age was made by Solis and Wade.[17] These workers confirmed in the main the findings of Gomez et al. In 60 per cent of the thirty-five children found positive, the bacilli were found on the skin only. They failed to find a case with positive nasal smears in the absence of positive skin lesions. Furthermore, positive smears from the nasal septum were most frequent in the oldest age groups.

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[16] Philip. Journ. Sci. 21 (1922) 233–256.

Table 13 gives with more detail the location of the initial lesion in forty-four of the fifty-nine positive cases (75 per cent) in whom such lesions were noted.

TABLE 13.—*Location of the initial lesion on the skin.*

Location of the initial lesion.	Number.	Per cent.
Buttocks	17	28.8
Cheeks	7	11.8
Thighs, posterior and lateral surfaces	5	8.5
Loins	4	6.7
Knees	3	5.1
Forearms, lateral and posterior surfaces	3	5.1
Dorsum of hands	2	3.4
Scapular region	1	1.7
Arms, posterior surface	1	1.7
Legs, lateral surface	1	1.7
No initial lesion seen	15	25.4

In 25 per cent of the cases no initial lesion was discovered. It seems very likely that in many of them a primary lesion may have previously existed on the skin but had only been missed or no visible lesions were produced. On the other hand, it is possible that in these cases the portal of entry may not have been the skin and the initial lesion may have been localized elsewhere. The first leprotic manifestations in such cases were a generalized rash, multiple pinkish or pale macules, or anæsthesia without any sign whatever of the skin involvement. Furthermore, in these cases the lesions appeared all over the body including the chest and abdomen, which regions were never found to be the sites of the initial lesion. Plate 2, fig. 1, shows a child 3 years 6 months old, with generalized pink macules, on whom no initial lesion was seen.

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[17] Bacteriological findings in children of lepers with special reference to the nasal septum. (In press.)

As to the location of the initial lesion, the striking feature is the limiting of the lesion to the posterior and posterolateral surfaces of the trunk and extremities, and to the cheeks. In the confirmed-leper, clinical-leper, and suspicious groups, representing in all one hundred sixty-seven cases, I have not seen a suspected primary lesion on the chest and abdomen, on the inner surfaces of the extremities, or on the genitals.

Knowledge of local customs as to the care of children is necessary to appreciate the data given above. The children are only scantily clad on account of the warm climate; trousers are not usually worn until the third or even the sixth year. Thus, the more or less exposed body of the child comes in direct and intimate contact with the mother, or with such infected objects as chairs, the floor, mats, the ground, etc.

There is another possibility which is believed worth considering. The characteristic location of the first lesions observed in the positive children suggests the possibility of the bedbug as the transmitting agent. The sites indicated in Table 13, including the cheeks, are just the places most liable to be bitten by bedbugs when the child is sleeping or sitting. Of course, it need hardly be mentioned that a large amount of investigation has already been done in connection with bedbugs, with inconclusive results. Acid-fast organisms, considered to be lepra bacilli, have been found in 10 per cent of three hundred two bedbugs fed on lepers, as reported by various workers, and 1 per cent of five hundred sixty-six specimens caught from lepers' quarters. The bacilli were never found in numbers that would suggest multiplication of the organism in the insect.

Nature of the initial lesion.—The commonest and most characteristic lesion is the pale pigmented macule already fully described by Gomez et al. The macules are usually irregular, pale or fawn-colored areas, not elevated but often with fairly distinct borders, presenting an even surface free from scales and varying in size from that of a rice grain to extensive areas covering the larger portion of an extremity or the back.

These areas show some impairment, however slight, of one or more of the elements of the cutaneous senses. The thermal and the pain sensations are frequently involved first, although there is seldom complete loss of sensibility. In older patches sweat is diminished or absent over the spot, and the hair is scanty or entirely missing.

The macules usually increase slowly in size, but they may gradually fade and disappear, even without treatment. The presence of a pinkish tinge at the borders or at the center indicates that the lesion is active and such areas are generally positive for *Mycobacterium leprae.* Plate 1, fig. 2; Plate 2, figs. 1 and 2; and Plate 3 show the general characteristics and the development of these macules. Less frequently seen are the pinkish macules appearing as such from the very start. Anæsthesia is seldom found to be an early manifestation in the Culion children, perhaps on account of the impossibility of eliciting it in many of them, for obvious reasons. Flushing of the skin at the pretibial regions is frequently associated with the pale areas, in children below 2 years of age. After some months the skin becomes dry and glistening, and later it becomes scaly. Occasionally it may be the only manifestation seen, preceding the multiple macules by several months.

The relative frequency of the different initial lesions or manifestations in the confirmed, clinically positive, and suspicious cases is given in Table 14.

TABLE 14.—*Relative frequency of different lesions or complaints that were first observed in confirmed, clinically positive, and suspicious cases.*

Initial lesion or symptom.	Confirmed lepers.		Clinical lepers.		Suspicious.	
	Cases.	Per cent.	Cases.	Per cent	Cases.	Per cent.
Pale macule	31	25.6	4	44.5	57	58.7
Pink macule	12	20.4	3	33.3	9	9.3
Anæsthesia	1	1.6	2	22.2	0	0
Flushing	0	0	0	0	5	5.1
No definite data	15	25.4	0	0	26	26.8

The pale macules are the commonest lesions observed, occurring in over 50 per cent of the positive and suspicious cases. The pink macules are also frequently seen; fifteen out of twenty-four cases showing such lesions were either confirmed lepers or clinically positive lepers. Anæsthesia was the first sign seen in one confirmed leper and in two clinically positive cases. Flushing of the legs was the exclusive sign in only 5 per cent of the suspicious cases.

Most of the children were too young to understand paræsthesia symptoms. In a group of one hundred fifty adult patients where early histories were carefully inquired into, fully 50 per cent felt these symptoms as the first manifestation of the disease or at least one of the earliest ones.

CONCLUSIONS

1. A single cutaneous lesion, which is believed to be the initial lesion, was observed in 75 per cent of the fifty-nine Culion children who have become definitely leprous.

2. In 25 per cent of these children no initial lesion could be found. The first clinical manifestations in them were a generalized rash or multiple macules appearing simultaneously.

3. The commonest sites of the initial lesion were the buttocks, cheeks, the posterior and lateral surfaces of the thighs, and the loins. The primary lesion was never seen on the chest or the abdomen, although these regions frequently show lesions in the more-advanced stages of the disease.

4. The initial lesion consists of a solitary pale or pinkish macule. In three cases the primary macule started from a scabies scar.

V a. EFFECT OF DELAYED SEGREGATION OF CHILDREN OF LEPERS

The removal of children of lepers from a leprous milieu immediately after birth is advocated by all leprologists as the only safe prophylactic measure against contagion of such children. In leprosaria where this practice is followed, the number becoming leprous is reduced to an insignificant minimum. Hasseltine[18] reports that of the one hundred twenty-one children of leprous parents born at the Molokai Leper Settlement during the period from July 1, 1909, to June 30, 1924, and removed immediately after birth to a nursery where they were cared for by nonleprous attendants, only one has developed leprosy. At the Almora Settlement in India, where for thirty years the children of lepers were brought up in a separate home, away from their parents, but one has become a leper.[19]

In 1916 a separate home was built within the staff reservation at Culion for the segregation of those children who did not yet show signs of leprosy. Isolation immediately after birth was attempted at the start but, owing to lack of proper facilities, this home was found to be unsuitable for infants and, therefore, only older children who no longer needed special care were admitted.

The Culion children may therefore be divided into two main groups: (1) Those who have lived continuously with their leper parents and have thus been exposed to the infection uninterruptedly since birth; and (2) a much smaller group, made up of children who were segregated at the Negative Children's Home, away from leper surroundings, at ages varying from 4 months to 10 years, the average age being 3 years 6 months.

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[18] U. S. Public Health Bull. 141 (1924).

[19] Jackson, In Leper Land. Marshall Brothers, London (1901) 108.

Effect of delayed segregation of children of lepers.—Since the establishment of the Negative Children's Home, March 25, 1915, to December 31, 1924, there have been one hundred twenty-three admissions to the home. Of this number twenty-nine have died, thirty have been returned to the Leper Colony as either positive or strongly suspicious lepers, twelve have been transferred to the settlement for causes other than leprosy, twenty have been discharged and given to nonleper relatives, and thirty-two were remaining at the home.

Table 15 gives the incidence of those becoming lepers, those remaining negative, those returned to the colony for causes other than leprosy, and the death rate among all the children admitted to the home, according to the age on admission.

TABLE 15.—*Incidence of leprosy among segregated children according to age on isolation.*

Age on admission.	Cases.	Returned to colony as lepers or suspected lepers.		Negative, discharged, and remaining.		Returned to colony for causes other than leprosy.		Deaths.	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Years.									
0 to 1	38	2	5.2	14	36.9	7	18.4	15	39.5
1 to 2	36	10	27.8	12	33.4	4	11.1	10	27.8
2 to 3	16	6	37.5	7	43.7	1	6.3	2	12.5
3 to 4	10	2	20.0	8	80.0	0	0	0	0
4 to 5	8	5	62.5	2	25.0	0	0	1	12.5
5 to 6	5	3	60.0	1	20.0	0	0	1	20.0
6 to 7	5	1	20.0	4	80.0	0	0	0	0
7 to 8	3	1	33.3	2	66.6	0	0	0	0
8 to 9	1	0	0	1	100.0	0	0	0	0
9 to 10	0	0	0	0	0	0	0	0	0
10 to 11	1	0	0	1	100.0	0	0	0	0

Although the various groups are too dissimilar in size to allow accurate comparisons, it will be observed that, with the exception of the 3-to-4-year group, the incidence of leprosy tends to increase with the period of exposure up to the sixth year. The age at the time of admission to the home is considered as the "period of exposure" in the sense that Hollmann uses it in his article; that is, it indicates the length of time the child has been exposed to the disease. In the 5-to-6-year group the incidence is practically the same as in the next preceding group; but thereafter it drops sharply, indicating that only a few of the children isolated after the age of 6 years developed the disease. The natural explanation for this is the elimination of the more-susceptible children who have become either positive or suspicious at earlier ages.

The percentage of those remaining negative among the segregated children does not show definite relation with those becoming positive. The twelve cases returned to the colony for reasons other than leprosy were children who did not thrive in the home and were returned to their parents at their request. All of these were below the age of 3 years.

Two of the thirty lepers were evidently infected during the first year of life, twelve before the end of the second year, and eighteen (60 per cent) before the fourth year.

The mortality was high among those admitted below the age of 1 year. There has been no death among those who were over 6 years old when admitted.

Comparison between the incidence of leprosy in segregated and in unsegregated children.—In order to determine the effects of delayed segregation of children of lepers it would be important to determine whether or not the incidence of leprosy has been diminished in such segregated children.

It has already been noted that, of the one hundred twenty-three admissions to the Negative Children's Home up to December 31, 1924, thirty have been returned to the colony as positive or strongly suspicious lepers, giving an incidence of 24.4 per cent. Only twenty-two of the thirty, however, were found to have been positive bacteriologically; the rest were either not bacteriologically examined at the time of transfer or were negative microscopically. Furthermore, the deaths, totaling twenty-nine out of the one hundred twenty-three cases, are included in Table 15. Therefore, considering only the positive cases and eliminating the deaths, the percentage of those who have become definitely leprous is found to be 23, which may be taken as the real incidence of leprosy among the segregated children.

Of the three hundred sixty-six unsegregated children living at Culion on December 31, 1924, forty-two, or 11.5 per cent, had become lepers. It is seen that, in the case of Culion children, delayed segregation has not only failed to diminish the incidence of leprosy but has also apparently increased it. This is certainly a most surprising result. Of course, certain factors have to be considered in interpreting these findings. In the first place, there are more of the younger children among those remaining in the colony, tending naturally to lower the incidence of positive cases. Then there is the difference in size of the groups. Furthermore, the children at the home were more closely watched than were those not segregated. Had it been possible to make more frequent bacteriological examination of the suspicious cases in the latter group, it is probable that more positive cases would have been found. Making due allowance for these legitimate objections, however, the ratio still mitigates against delayed segregation, so that some other explanation must be sought.

After careful study of the data on hand I am inclined to ascribe this seemingly paradoxical result to the fact that the segregated children were as a rule less well cared for than were the children who were brought up by their own parents, so that the segregated children were less able to fight off the infection which most of them had doubtless acquired before segregation. Once more, the importance of the general health on the susceptibility to infection is clearly shown. Of the thirty-two remaining at the home on December 31, 1924, nineteen (59 per cent) showed macules or other suspicious lesions of leprosy.

Evidently, segregation of the children born at Culion must be done earlier than at present. Plans are under way to remodel the entire building, converting it into a nursery to which all children born in the colony will be removed as soon as possible after birth.

There is no difference in the ages at which the lesions became positive in segregated and unsegregated children; the average age in the unsegregated children was 5 years 9 months, and in the isolated children the corresponding average age was exactly the same.

V ^{b}. PROBABLE INCUBATION PERIOD IN SEGRAGATED AND UNSEGREGATED CHILDREN OF LEPERS

Basing their calculations on the data given by Gomez, Avellana Basa, and Nicolas on twenty-two segregated children who have become either positive or suspicious lepers, Rogers and Muir[20] have concluded that the average incubation period in these children was three and one-half years. How they obtained this figure is recorded by them as follows:

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[20] Leprosy. W. Ward & Co., New York (1925).

> * * * We have supposed susceptibility to be equal throughout the whole period of exposure and have taken half of this period to be the average time of infection; to this we have added the time which elapsed between isolation and the appearance of the first sign of the disease * * *.

They calculated half of the average period of exposure to be one year six months sixteen days, to which was added the average isolation period of two years eight days, giving the total of three years six months as the incubation period.

Following the method of Rogers and Muir, and considering only the positive cases in the series reported by Gomez et al., to which were added the eight new cases becoming positive after their report, I obtained an average incubation period of three years nine months, which closely approximates the figure obtained by Rogers and Muir.

Again, assuming that children of all ages are equally susceptible to infection, Rogers and Muir calculated that the probable average age at which infection took place in children who were continually exposed to their parents is half the period of exposure. As the average age at which the children living in the colony were found positive was 5 years 9 months, the incubation period calculated according to this method would be two years ten months.

Therefore, based on the methods of calculation proposed by Rogers and Muir, the incubation period for the segregated children would be three years nine minths, while in the unsegregated children it would be only two years ten months. However, since the average age at which the children were found positive is identical in both groups, it is probable that the average age at which infection took place is also the same in both. The amount of error in the method of calculating the average incubation in the segregated children should be slight, as the average period of exposure is comparatively short. Evidently the calculated figure for the unsegregated cases is erroneous, and an average incubation period of three years nine months in both groups probably is nearer right than is two years six months, proving that the younger children are more susceptible than the older ones.

Considering the incubation period in both groups, then, to be three years nine months, and subtracting this from the average age at which the children became positive, which is 5 years 9 months, the average age of infection would thus be 2 years.

It has not been possible to keep track of most of the children who have been given to nonleprous relatives. However, three of them have already been returned to Culion as lepers; two had been removed from Culion at the age of 2 years, and one at the age of 7 months 17 days. Of thirty cases sent away before the age of 6 months, none has been returned.

It is evident that, in the case of the Culion children, infection takes place on the average at about the second year, and after the sixth month.

It is obviously important to determine how long a child must be segregated before he can safely be discharged. The regulations at present followed at Culion prescribe an observation period of not less than four to five years in children who have been exposed to the disease for over six months. Although in the majority of the cases the leprotic lesions appeared well within a period of four years, one child developed the first suspicious signs four years two months after isolation; so that, to provide a fairly wide margin of safety, the observation period of such children should be definitely fixed at five years.

CONCLUSIONS

1. In a group of segregated children of lepers removed from all contact with the disease at an average age of 3 years 6 months, 23 per cent have become leprous.
2. Segregation of the children of lepers delayed after the age of 6 months does not decrease the incidence of leprosy, nor does it delay the appearance of the disease among them.
3. The probable average incubation period among the segregated and unsegregated Culion children is three years nine months.
4. The observation period for children of lepers segregated after the age of 6 months should cover at least five years.

ILLUSTRATIONS

PLATE 1

FIG. 1. Showing the development of the initial lesion from a scabies scar. *a*, old scabies scar; *b*, a fresh scar with a faint areola of depigmentation. This is ordinarily seen in Filipino children when such scars are recent; *c*, a suspicious macule of leprosy developing around an old scar; *d*, the initial lesion arising from a scabies scar. This lesion was positive for *Mycobacterium leprae*, but later became negative after six months' treatment.

2. Extensive, multiple macules.

PLATE 2

FIG. 1. Generalized pink macules in a girl three and a half years old. In this case, the initial lesion was not seen. The disease broke out in the form of a rash with considerable fever but without prostration.

2. A somewhat more advanced stage. Secondary lesions have appeared.

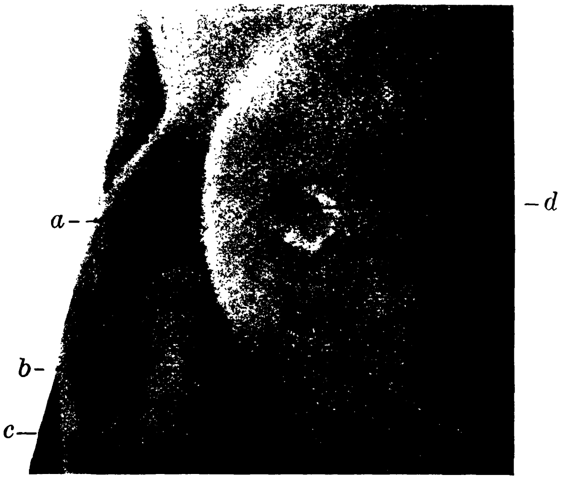
PLATE 3

FIG. 1. The initial lesion originating from an old scabies scar.

2. Another primary lesion.

TEXT FIGURE

FIG. 1. Chart showing the incidence of leprosy in male and in female children.



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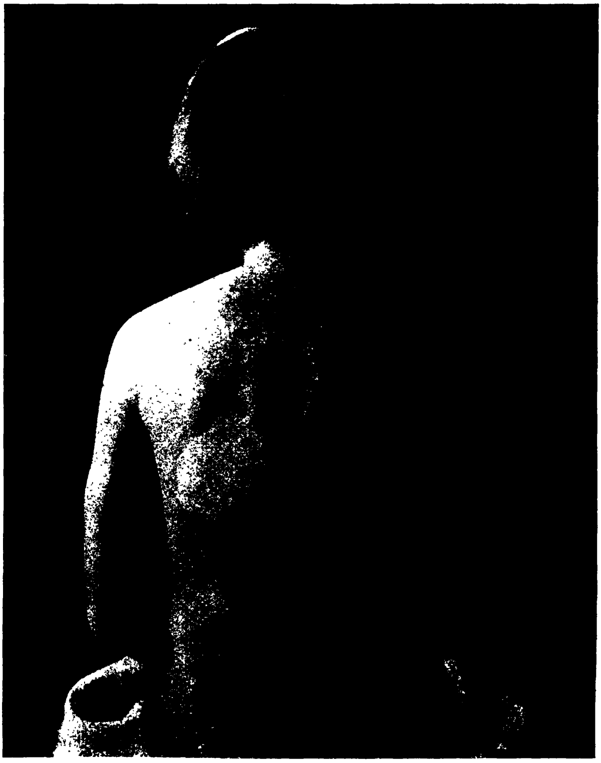

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PLATE 1.

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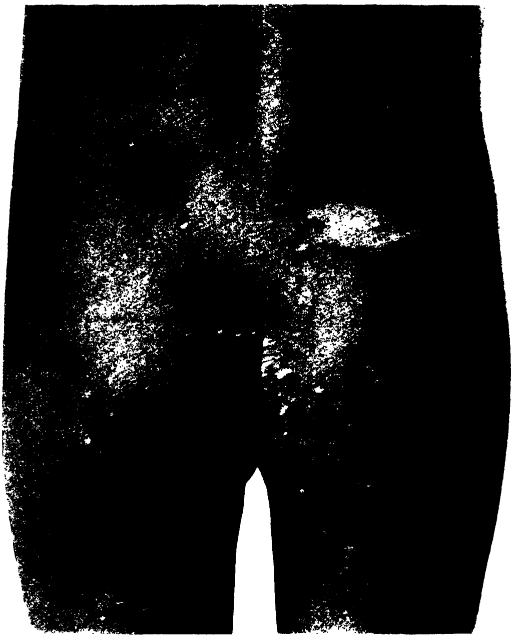
2

PLATE 2.



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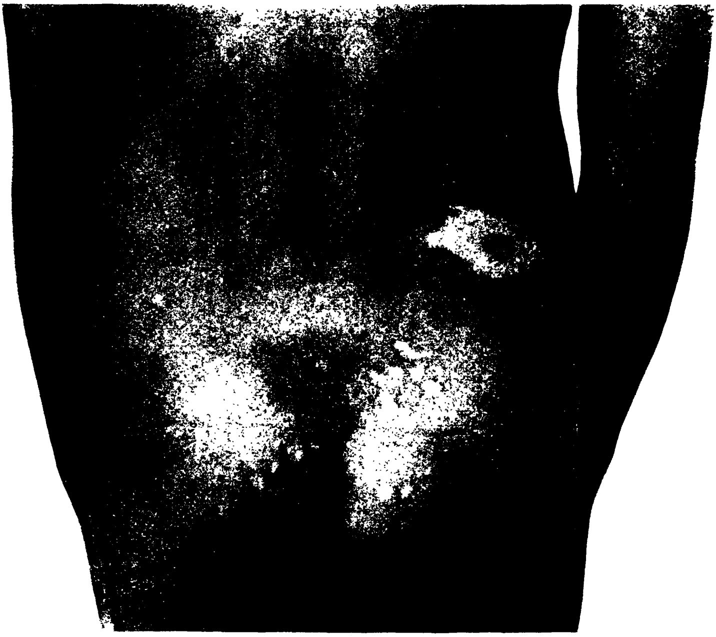

2

PLATE 3.

CONGENITAL ABSENCE OF BOTH HIND LEGS IN AN ADULT PIG

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TWO PLATES

INTRODUCTION

Malformations of the extremities in mammals are of various types, ranging from complete or partial lack of members to the presence of supernumerary limbs and digits. From a survey of the literature on hand, it is evident that cases of congenital absence of both hind legs are comparatively rare. Hence, it appears that there is some justification for reporting the present monster. Further, the data furnished by this specimen may constitute a definite contribution to our inadequate knowledge of the anatomical peculiarities of this form of abnormality in adults. Concerning the importance of studying various forms of malformation, Ballantyne(2) says the following:

> Indeed the inquiry into several types of malformation and structural anomaly has repeatedly thrown light not only on the malformation or anomaly itself but also upon the normal process of development the disturbance of which it represents.

A review of Piersol's(8) illustrations of the different classes of congenital deficiencies of the extremities in human beings failed to show a case in which both lower limbs were absent. Mall,(7) in his tables of various forms of localized anomalies in pathological and normal embryos, records no example of a human monster that falls in the same category as the specimen here reported. The occurrence of this deformity in domestic animals is frequently heard of; but, so far as I was able to learn, the only case recorded that closely resembles this one is the two-hour-old pig reported by Carreon.(3) His specimen, in addition to the absence of both hind legs below the femur, is characterized by the presence of cleft palate, a condition not observed here. Craig(5) and Williams,(10) in their treatises on monstrosities, neither mention nor illustrate a case with both hind legs missing. Perhaps the lack of clinical importance that the present type of monster offers accounts for this omission.

Like many other forms of localized anomalies, the etiology of congenital deficiencies of the extremities is still a matter of uncertainty. The drift of opinion, however, among investigators is toward the conclusion that they are not due to hereditary and germinal influences. Mall(6) seems to advocate the theory that they are due to arrest of development arising from defective nutrition. Piersol,(8) on the other hand, seems to entertain the idea that amniotic bands and adhesions are potent causes in the production of congenital deficiencies of the extremities.

MATERIAL

The present pig monster was obtained from the department of animal husbandry, College of Agriculture, through the kindness of Mr. Mondeñedo, to whom I wish to express my sincere thanks for having made the present study possible. The pig was presented to the department by a student and it was exhibited at the Laguna Provincial Fair, held on the campus of the Los Baños College from May 24 to 31, 1924. It was a boar, 25.5 kilograms in weight, 73 centimeters in body length (crown–rump measurement), 59 centimeters in height, and 65.5 centimeters in body circumference (measurement taken behind the dorsal angle of the scapula). No record was available of the exact age and parental history. Judging, however, from the general appearance of the animal and from the length of the tusks, it was doubtless a native pig of about 4 years of age.

Before the animal was killed and embalmed, a thorough examination of the different parts of the body was made, and its attitude both at rest and in motion carefully observed for several days. The photograph of the monster in its favorite position is shown in Plate 1, fig. 1. It is interesting to note that, in spite of the missing hind legs, the animal was able to move from place to place. While moving, the perineal region had to be rubbed against the floor, and the trunk held in so oblique a position that its long axis formed an angle of about 45° with the ground plane. The animal had perfect control over its hind parts; they could be extended or flexed at will. While eating it maintained a position with the knees resting on the ground and with the trunk so twisted that the right hip region had to come in contact with the ground. In a recumbent position it preferred to lie on the right side. Apparently the assistance rendered by the femur in rising accounts for this.

The sexual instinct seemed to be perfectly normal. In the presence of a sow, especially a strange one, the pig invariably showed erection of the penis and other symptoms of ardent desire for sexual intercourse. As one can easily conceive, however, attempts to mount always failed.

SURFACE ANATOMY

The skin of the dorsal aspect of both knees was abnormally thick, free from hair, and somewhat horny. The mammary glands were uneven in number, there being only four teats on the left side, one less than on the right. There was a complete fusion of the soles and the lower parts of the interdigital surfaces of the hoofs of the third and fourth digits of the right anterior foot. The hind legs were completely absent; otherwise, the pig appeared to be a perfectly normal individual. Careful inspection and palpation of the deformed hind parts revealed the presence of a ventral cutaneous pouch on the right side. The bottom of the pouch was thick, hairless, and somewhat scaly, indicating evidently its frequent rubbing against the ground during life. Inclosed within the pouch, but not attached to it, was felt a hard rounded mass, which, upon dissection, proved to be the distal extremity of the right femur. It was observed that the animal had to depend very much upon this bone in supporting the weight of the caudal portion of the body while getting up and moving from place to place.

The left gluteal region was slightly depressed, due evidently to its poorly developed muscles, which subject will be alluded to later. About 5.5 centimeters from the root of the tail and about 2 centimeters from the dorsal median line was a well-defined eminence which, upon dissection, proved to be due to the deformity of the transverse processes of the fourth and fifth coccygeal vertebræ. In the examination of the perineal region, only the left testicle was discovered; the right one was found to lie in front of the distal fourth of the right femur and underneath the fold of the flank. The penis presented no apparent abnormality, except the slight displacement of its body toward the right side. Apparently the stretching of the skin toward that side accounts for this condition.

INTERNAL ANATOMY

A general statement should be made here, to the effect that, aside from the hind quarters and one of the fore feet, all other parts of the body of this pig monster—including the bones, muscles, heart, principal arteries, veins and nerves, respiratory apparatus, central nervous system, and digestive and urinary organs—were observed to be perfectly normal. For this reason, it is believed that it would be superfluous to include their description in the present brief account. As will be noted, the following discussion of the internal anatomy is mostly confined to the parts that were found to be involved in the deformity.

SKELETON

In the deformed hind parts of the present specimen the bones that were discovered to be affected were the lumbar vertebræ, the sacrum, the coccygeal vertebræ, and the bones of the pelvic limbs. These bones are all illustrated in Plate 1, fig. 2. With the exception of the fusion of the lower margins of the interdigital surfaces of the third phalanges of the third and fourth digits of the right anterior limb, the rest of the bones of the fore limbs appeared to be perfectly normal.

The last of the five lumbar vertebræ that were present is the only one that presented some abnormal features. Its left arch was fused completely with the anterior border of that of the first sacral vertebra but it failed to fuse with its fellow on the right side, the two arches having been united by only the fibrous connective tissue. The spinous process was supported by the right arch only and was comparatively smaller than any of those of the first four vertebræ. Its direction was toward the left side. The transverse processes differ in size, the left one being much broader and longer than the right. According to Sisson(9) and Chauveau,(4) the transverse processes of the last lumbar vertebra in a normal pig form no articulation with the sacrum. In this specimen, however, they were observed to articulate not only with the sacrum but also with the ilium.

The sacrum was very much deformed and presented only three rather imperfectly developed vertebræ. The first one offered the most-striking characteristic features. Its arches were not fused but only overlapped each other. The left arch was more extensive than the right and presented a fairly well-developed spinous process which was directed toward the right side. The left sacral wing was very poorly formed and was not fused with the body; its attachment to the latter was by means of a thin plate of cartilage. The dorsal sacral foramina on the left side were placed somewhat farther forward than were those on the opposite side.

There were only eleven coccygeal vertebræ. The absence of functional articular processes and complete arches on the first five, and the division of the transverse processes of the fourth and fifth into dorsal and ventral plates were the most salient aberrant features.

The shaft of the ilium of the left os coxæ seemed to be more massive than that of the right. The left acetabulum was absent, and in its place was found a tuberosity, the medial surface of which formed a deep groove with the ischium and the pubis. In the right os coxæ, the only feature deserving notice was the depression situated on the lateral surface of the ischium, just below and behind the ischiatic spine. To this depression was fitted the summit of the trochanter major of the right femur.

Below the os coxæ on the left side, the only bone found was the rudiment of the proximal extremity of the femur. It was a small flattened bone measuring about 3 centimeters in length and 2 centimeters in its widest middle part. Its direction was forward and upward, and it formed no articulation with the os coxæ. The anterior extremity and the anterior half of the lateral surface were rough and furnished attachments to muscles. The inferior border presented a well-defined central eminence which was found to articulate below with a piece of cartilage.

In the right pelvic limb, the only bones that were present below the os coxæ were the femur and the patella. The fovea capitis was absent; otherwise the proximal extremity of the femur appeared to be normal. The trochlea and the condyles, however, of the distal extremity were imperfectly developed. The intercondyloid fossa was represented by only a narrow, shallow groove. The shaft was not so massive as in a normal individual. There was no evidence of either the lateral or the medial supracondyloid crest.

Comparison of the length of the femur and that of the humerus on the same side showed that the former was 0.3 centimeter shorter than the latter, its length being 15.2 centimeters as against 15.5 centimeters for the humerus. This condition evidently shows that the femur did not reach its full development even in length, because, when the femur and humerus of the skeletons of five adult normal pigs were compared, it was found that, invariably, the femur exceeded the humerus in length by an average of 4.86 centimeters.

The patella was somewhat spherical, and it was found to articulate with the lower part of the anterior surface of the femur, instead of with the trochlea. Arising from its lower part was a single broad ligament which passed over the trochlea to be attached to a shallow, transverse depression at the junction of the trochlea and the condyles.

MUSCLES

For the sake of brevity, the most salient aberrant features presented by the individual muscles in the deformed hind parts are summarized as follows:

MUSCLES OF THE LEFT HIP AND THIGH

Tensor fasciæ latæ.—Very much undersized; posteriorly, it was fused with the gluteus superficialis, and deeply with the anterior part of the gluteus medius. Below, it had no direct attachment to any bone; its aponeurotic portion simply blended with the fascia covering the ischiatic division of the biceps femoris.

Gluteus superficialis.—Represented by a narrow thin muscle which joined the sacral division of the biceps femoris on its way down. This muscle corresponds to the ilial head found in the horse which, as a rule, does not exist in a normal pig. The muscle had its origin in the tuber coxæ and was inserted in the dorsal part of the tuber ischii, in common with the sacral portion of the biceps femoris.

Gluteus medius.—Comparatively small and tendinous, and the insertion was anomalous. The deep part or gluteus accesorius terminated in a strong tendon which passed backward, downward, and then forward through the groove formed by the tuberosity and the ischium and pubis, as already referred to in connection with the description of the left os coxæ. It joined the common tendon of the iliacus and psoas major. The superficial part was also provided with a tendon which was inserted in the anterior aspect of the cartilage that was found articulating with the rudiment of the proximal extremity of the femur.

Gluteus profundus.—Very poorly developed, being represented only by a small, flat, tendinous structure, having its origin from the superior ischiatic spine and adjacent part of the shaft of the ilium. It was provided with a terminal tendon which joined that of the deep part of the gluteus medius.

Biceps femoris.—Appeared to be rudimentary. Its sacral and ischial divisions presented a peculiar relation; the former formed an angle of about 80° with the latter. The sacral division originated from the gluteal fascia principally and was inserted in the tuber ischii, in common with the gluteus superficialis. Its tendon of insertion was partly under cover of the superficial part of the ischial division. The latter division could be separated into superficial and deep parts. The superficial part had its origin from the tuber ischii, below and behind the insertion of the gluteus superficialis, and it was inserted in the abdominal fascia. The deep part was found lying under cover of the semimembranosus from which it was difficult to separate it. The origin was on the tuber ischii and the adjacent part of the lateral surface of the ischium, and the insertion was on the rough anterior half of the lateral surface of the rudiment of the proximal extremity of the femur.

Semitendinosus.—Very small and narrow, lying behind the sacral division of the biceps femoris; the ischial head was apparently absent. The muscle was attached above to the dorsal plates of the split transverse processes of the fourth and fifth coccygeal vertebræ, and below to the tuber ischii.

Semimembranosus.—Thin and very poorly developed. The fibers were directed forward and slightly upward. Posteriorly it was attached to the fascia of the perineum and anteriorly it was blended with the deep part of the ischial division of the biceps femoris, which had its insertion on the rough anterior half of the rudiment of the proximal extremity of the femur.

Sartorius.—Abnormally short and narrow. It terminated below by just joining the gracilis at a right angle.

Gracilis.—Very rudimentary, consisting of only a thin, rather tendinous structure of about 1.5 inches in width. It was directed outward and was inserted in the fascia covering the semimembranosus and the adjacent part of the ischial division of the biceps femoris.

Pectineus.—Abnormally small and so flattened that it looked as if it were a part of the preceding muscle, from which it could be separated only with difficulty. The prepubic tendon was its principal point of origin, and the fascia covering the semimembranosus and biceps femoris furnished its insertion.

Adductor.—Very rudimentary and was inserted in the posterior end of the cartilage that was found articulating with the rudiment of the proximal extremity of the femur.

Obturator externus and obturator internus.—Both provided with terminal tendons which united to form a common tendon. The conjoined tendon passed forward and upward to terminate in the tendon of insertion of the gluteus accessorius.

Quadriceps femoris.—Of the four heads only the rectus femoris was present. It consisted of a very short tendinous structure that was found attached above to the border of the shaft of the ilium, and below to the rough anterior end of the rudiment of the femur.

Iliacus and psoas major.—The only sublumbar muscles that were observed to present some abnormal features. They were very much undersized and their common tendon of insertion joined that of the gluteus accessorius, as stated elsewhere in this paper.

MUSCLES OF THE RIGHT HIP AND THIGH

Tensor fasciæ latæ.—Comparatively better developed here than on the opposite side. It terminated in a thin aponeurosis which blended below with the thick layer of fibrous tissue lining the cutaneous pouch.

Gluteus superficialis.—Presented no ilial part and was abnormally long, its terminal tendon being attached to the lateral epicondyle of the femur.

Biceps femoris.—Better developed than its fellow on the other side. The sacral and ischial divisions were fairly distinct and presented no obvious aberration in their points of origin. The sacral division, on its way down, was partly attached to the upper part of the tuber ischii, and it was provided with a narrow tendon which blended with the superficial layer of the fibrous connective tissue capsule covering the distal extremity of the femur. The ischial division was separable into anterior and posterior parts, the former lying medial to the sacral division, and the latter behind it. The posterior part was attached above to the upper part of the tuber ischii, just below the attachment of the sacral division, and below to the fibrous connective tissue capsule referred to above. The anterior part had its origin from the lateral surface of the ischium and the tuber ischii, and it was inserted in the upper two-thirds of the lateral border of the femur.

Semitendinosus.—The sacral part was similar in attachment to its fellow on the other side. The ischial part was attached above to the tuber ischii, immediately behind the biceps femoris, and below, by means of its strong aponeurosis, to the thick deep layer of the fibrous connective tissue capsule covering the distal extremity of the femur.

Semimembranosus.—Had its distal attachments to the lower fourth of the posterior surface of the femur and to the medial epicondyle.

Gracilis.—Presented a caplike distal portion which covered the lower end of the femur, just outside the fibrous connective tissue capsule. Its insertion was found to be on the patella and lateral epicondyle of the femur.

The gluteus medius, gluteus profundus, quadriceps femoris, adductor, pectineus, obturator externus and internus, iliacus, and psoas major and minor appeared to be better developed than their respective fellows on the left side; and in their relations and attachments they presented nothing of interest. In Plate 2 are illustrated the superficial muscles of the right and left hips and thighs.

BLOOD SUPPLY OF THE DEFORMED PARTS

The renal arteries and the posterior or small mesenteric artery were apparently normal, both in size and in points of origin. The right internal spermatic artery, however, was observed not to rise directly from the aorta (as in the case of its fellow on the other side), but from the root of the posterior mesenteric artery. The latter blood vessel was given off from the ventral aspect of the aorta, a little below the level of the origin of the left internal spermatic artery. No obvious abnormality was observed in the relations of the terminal branches of the abdominal aorta at their points of origin; their collateral and terminal branches were distributed as follows:

The external iliac arteries.—Both left and right circumflex arteries, the first branches given off, presented nothing of special interest. The left circumflex artery was followed by two large but short branches which apparently had no homologue on the right side. They were very close at their points of origin and ramified in the tensor fasciæ latæ and prefemoral lymph gland. On the right side the muscle and the lymph gland received their blood supply from the branches of the right circumflex artery. The next collateral branch given off by the external iliac artery on either side was a large, long one. It supplied the sartorius, gracilis, and semimembranosus muscles on the corresponding side. The last branch was comparatively smaller than the preceding, especially on the left side; it terminated in small twigs which ramified in the rectus abdominis and superficial inguinal lymph gland. The terminal branches of the external iliac artery were distributed chiefly to the pectineus, obturator externus, and adductor.

The internal iliac or hypogastric arteries.—The largest two collateral branches of these blood vessels were the anterior and posterior gluteal arteries. The former appeared to be perfectly normal, both in size and in general distribution. The right posterior gluteal artery, however, was much longer and larger than the corresponding left one. This condition may be accounted for by the better development on the right side of the biceps femoris, semitendinosus, and other adjacent muscles, to which the principal branches of the artery in question were chiefly distributed. The internal iliac artery on either side was continued backward by the internal pudic artery which, after giving off branches to the rectum, urinary bladder, and accessory genital organs, passed backward to the ischial arch where it terminated in two branches, the arteria dorsalis penis and the arteria profunda penis.

The middle sacral artery.—This blood vessel had its origin from the dorsal aspect of the aorta, a little above the bifurcation of the latter into left and right internal iliac arteries. It seemed to be unusually small and was continued backward by the middle coccygeal artery. About 1.5 centimeters from its point of origin it gave rise to the last pair of the lumbar arteries.

NERVE SUPPLY OF THE DEFORMED PARTS

Both the location and the formation of the lumbo-sacral plexus, from which are derived the nerves of the pelvic limb, were observed to be perfectly normal; its last three lumbar (ventral branches) and first sacral components could be easily recognized. Its principal branches (the femoral, obturator, anterior gluteal, posterior gluteal, and great sciatic nerves) were apparently normal in their points of origin and relation, but they seemed to be abnormally small in caliber. No attempt was made to trace the final ramifications of the branches of the nerves above mentioned.

GENITAL ORGANS

The features that were observed to be anomalous in the genital organs were the slight displacement of the body of the penis toward the right side, the location of the right testis in the lower part of the flank, the very poorly developed tunica vaginalis on the right, and the marked difference in size of the two sex glands. The right testis was very much smaller than the left and was provided with an abnormally thin tunica vaginalis.

The latter structure was closely applied to the aponeurotic portion of the obliquus abdominis externus, to which it was attached by loose fibrous connective tissue. Including the epididymis, the right testis measured 5 centimeters in length and weighed 26.5 grams, whereas the left one measured 8.6 centimeters and weighed 54.4 grams. Histological examination showed that both glands were normal; the presence of fully developed spermatozoa in the tubules of the epididymis of either gland suggests that they were also functional.

SUMMARY AND CONCLUSIONS

1. A review of the available literature on teratology showed that cases of congenital absence of both hind legs in mammals are comparatively rare, and that, like other forms of localized anomalies, the etiology of this type of malformation has not been definitely determined.

2. At least in pigs, complete or total absence of both hind legs does not seem to render life impossible. It is beyond question, however, that with such deformity the struggle of the individual for existence must be painful and difficult.

3. According to the classification of malformations of the extremities, adopted by Bailey and Miller,(1) the present pig monster falls under abrachius apus, which implies the suppression of either the thoracic or the pelvic limbs, the remaining pair being normal.

4. With the anatomical data furnished by the present specimen it is very difficult, if not impossible, to decide what constituted the immediate cause of the arrest of development of the hind limbs. I believe, however, that the absence of any external indication of atrophied extremities is sufficient evidence that the deformity was not brought about by the amputation of the already formed legs by the encircling amniotic band or the umbilical cord.

5. With the exception of the complete fusion of the soles and the lower parts of the interdigital surfaces of the hoofs of the third and fourth digits of the right limb, and the partial fusion of the corresponding phalanges, the anterior extremities of this pig presented nothing unusual.

6. The bones that were found to be included in the deformity were the lumbar, sacral, and coccygeal vertebræ, the ossa coxarum, and the femora. Below the os coxæ on the right side

only the imperfectly developed femur and patella were present, and on the left, only the rudiment of the proximal extremity of the femur.

7. The left side seemed to be more severely affected, the femur being represented by only the rudiment of its proximal extremity, and the muscles comparatively poor in development. The quadriceps femoris, which was found to possess four fairly well developed heads on the right side, was represented here by only the rudiment of the rectus femoris.

8. No distinct quadratus femoris and gemellus could be recognized on either side. In general, the most striking anomalies of the muscles were their development and insertions.

9. Whether the muscle anomalies in the present case are a consequence of the defects of the skeleton or were independent of them is not known.

10. The abdominal aorta and its branches presented nothing to cause suspicion of defective development of the early embryonic circulatory system in the deformed hind parts of the animal. Neither did the blood vessels that were distributed to the different muscles present evidence that any abrupt changes had taken place during the early part of the development of the pelvic limbs.

11. The erection of the penis and the exhibition of other symptoms of ardent desire for sexual intercourse, when in the presence of the opposite sex, are conclusive evidence that the sexual instinct was not at all deranged.

12. Aside from the comparatively small size and the displacement of the right testis in the region of the flank, the sex glands appeared to be normal, both in structure and in function. The penis presented no noticeable abnormality, other than the slight displacement of its body toward the right side.

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ILLUSTRATIONS

[Photographs by Mr. Dionisio Aquino, Department of Agronomy, College of Agriculture.]

PLATE 1

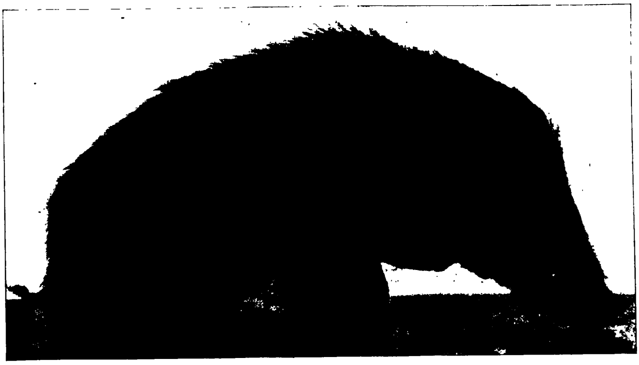
FIG. 1. The pig monster in its favorite posture.

2. Showing the bones present in the deformed hind parts of the animal. 1, lumbar vertebræ; 2, 2′, sacrum; 3, coccygeal vertebræ; 4, 4′, ossa coxarum; 5, right femur; 6, right patella; 7, the rudiment of the proximal extremity of the left femur.

PLATE 2

FIG. 1. Showing the relations of the superficial muscles of the left hip and thigh. 1, gluteus medius; 2, sacral division of the biceps femoris; 3, tensor fasciæ latæ; 4, ischial division of the biceps femoris; 5, semimembranosus; 6, semitendinosus; 7, sphincter ani externus; 8, left testis; 9, cutaneous pouch; 10, aponeurotic portion of the obliquus abdominis externus; 11, superficial inguinal lymph gland; 12, prefemoral lymph gland; 13, tuber coxæ; 14, body of the penis; 15, gluteus superficialis; 16, anus.

2. Showing the relations of the superficial muscles of the right hip and thigh and the location of the right testis. 1, gluteus medius; 2, tensor fasciæ latæ; 3, gluteus superficialis; 4, quadriceps femoris; 5, sacral division of biceps femoris; 6, ischial division (superficial part) of biceps femoris; 7, semitendinosus (ischial part); 8, sphincter ani externus; 9, right testis (still covered with tunica vaginalis); 10, thick layer of fibrous connective tissue lining the cutaneous pouch; 11, obliquus abdominis externus; 12, tuber coxæ; 13, prefemoral lymph gland; 14, gracilis (posterior part); 15, caplike portion of the gracilis over the distal extremity of the femur; 16, anus.



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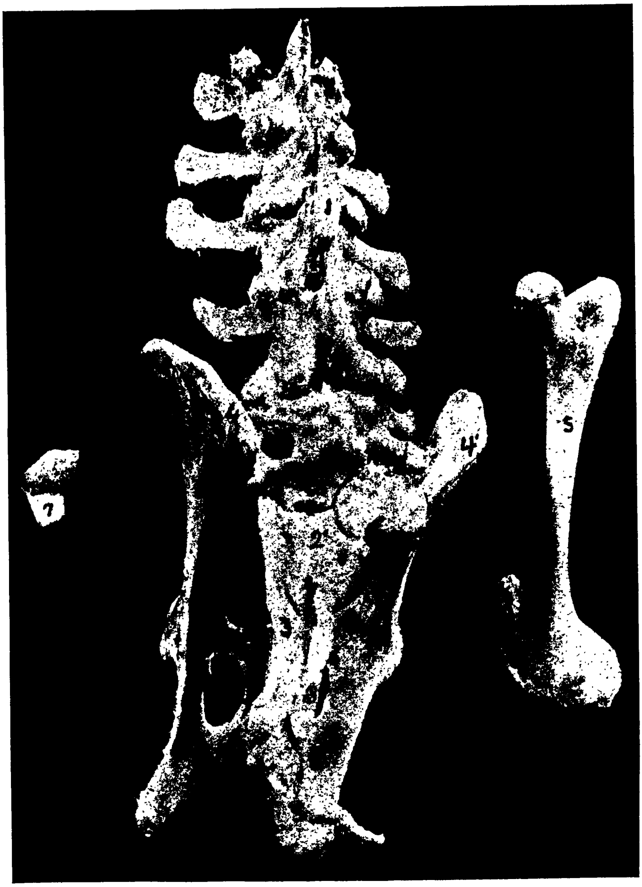

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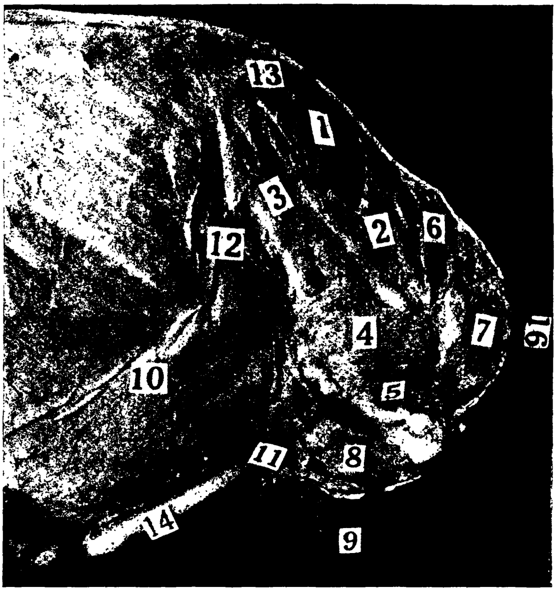
PLATE 1.



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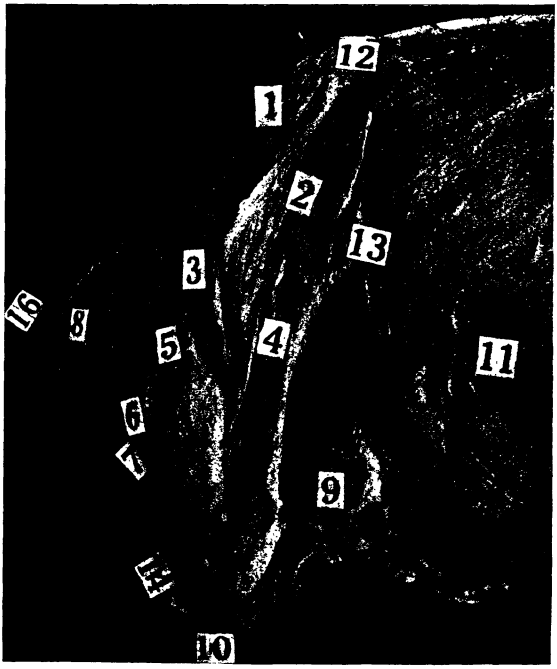

2

PLATE 2.

ESTERS OF CHAULMOOGRIC ACID (CAPRYL, ALLYL, PHENYL, ORTHO CRESOL, META CRESOL, PARA CRESOL)

By P. P. HERRERA-BATTEKE

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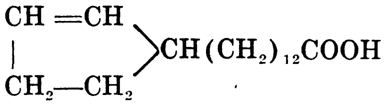
and

AUGUSTUS P. WEST

Professor of Chemistry, University of the Philippines

The treatment of leprosy by means of the mixed ethyl esters obtained from the fatty acids of chaulmoogra oil has given excellent results. However, as this method of treatment is a slow process it would seem highly desirable to prepare other chaulmoogra derivatives which may, perhaps, have greater therapeutic value than the mixed chaulmoogra ethyl esters. Some work along this line has already been carried out in various laboratories.

Power and his associates[1] were the first to make a thorough investigation of chaulmoogra oil. Power prepared the methyl and ethyl esters and a number of salts and derivatives of chaulmoogric acid, which is one of the principal constituents of chaulmoogra oil. Power considered chaulmoogric acid to be an equilibrium mixture of two isomers. He proposed the following as one of the two possible formulas of chaulmoogric acid:



The recent investigation of Shriner and Adams[2] appears to confirm this formula as representing in a satisfactory manner the chemical behavior of chaulmoogric acid and seems to establish the fact that chaulmoogric acid does not exist in a tautomeric state.

Perkins[3] prepared the propyl, butyl, and amyl esters of the mixed chaulmoogra acids. Some mercury derivatives[4] have also been made.

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[1] Power, F. B., and F. H. Gornall, Journ. Chem. Soc. Trans. **85**[1] (1904) 838 and 851; Power, F. B., and M. Barrowcliff, ibid. **87** (1905) 884.

[2] Journ. Am. Chem. Soc. **47** (1925) 2727.

[3] Philip. Journ. Sci. **24** (1924) 621.

Leonard Rogers[5] used a mixture of sodium salts of the fatty acids of chaulmoogra oil for the treatment of leprosy. Walker and Sweeney[6] found that both sodium and potassium salts of the total fatty acids of chaulmoogra oil have a high selective antiseptic action on acid-fast bacilli, but the other ordinary salts of chaulmoogra acids are insoluble in water and therefore unsuitable for practical use.

Schöbl[7] carried out an extensive investigation on chaulmoogra derivatives and numerous other compounds, to determine their growth-inhibiting activity toward acid-fast bacilli in vitro. In a subsequent research Schöbl[8] concluded that the growth-inhibiting activity of chaulmoogra oil depends principally on the unsaturated ring structure of the compounds contained in the oil because, when it was hydrogenated and the unsaturated glycerides converted to saturated glycerides, the oil lost its growth-inhibiting activity. The experiments carried out by Schöbl also indicated that the length and structure of the side chain of chaulmoogric-acid derivatives influenced the therapeutic activity of these substances.

In addition to the work that has been done on chaulmoogra derivatives and similar substances, other *Hydnocarpus* oils similar to chaulmoogra have been investigated.[9]

EXPERIMENTAL DATA

The chaulmoogra oil used in this investigation was obtained from the seeds of the variety of chaulmoogra known as *Taraktogenos kurzii* (King). Our supply of oil was kindly presented to us by Dr. G. A. Perkins, chief chemist of Culion Leper Colony.

Chaulmoogric acid.—In preparing chaulmoogric acid the chaulmoogra oil was saponified in the usual manner with alcoholic (aldehyde-free) potassium hydroxide. The excess alcohol was eliminated by distillation and the residual soaps then decomposed with dilute hydrochloric acid. The mixed acids thus obtained were then poured into a large beaker and, on standing, they solidified as a hard soapy mass. The acids were then filtered and washed with water until the aqueous filtrate was no longer acidic to litmus. The acids were then dried on sheets of filter paper, after which they were crystallized from each of the following solvents: Ethyl alcohol (95 per cent), methyl alcohol, petroleum ether, and acetone. By this procedure the chaulmoogric acid was obtained as glistening plates, which melted at 68°.

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[4] Dean, A. L., R. Wrenshall, and G. Fujimoto, Journ. Am. Chem. Soc. 47 (1925) 403.

[5] Ind. Journ. Med. Rev. 5 (1917) 277.

[6] Journ. Inf. Dis. 1 (1920) 1.

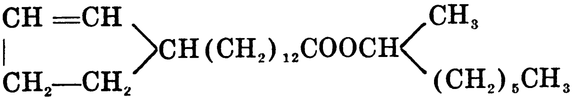
[7] Philip. Journ. Sci. 25 (1924) 123.

[8] Philip. Journ. Sci. 25 (1924) 135.

[9] Perkins, G. A., and A. O. Cruz, ibid. 23 (1923) 543; Schöbl, O., ibid. 23 (1923) 535; 24 (1924) 23.

Chaulmoogra oils usually contain varying amounts of resinous matter. The crystallization from petroleum ether is very necessary, as the yellow resins are thus precipitated while the chaulmoogric acid dissolves, giving a colorless solution. Sometimes a portion of the resins remains in solution in a somewhat colloidal form. In such a case it is advisable to add anhydrous sodium sulphate to the hot petroleum ether solution of chaulmoogric acid. The sulphate tends to break up the colloid and precipitate the resins more completely.

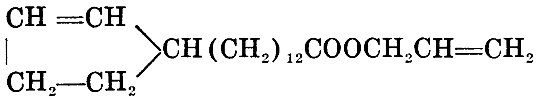
CAPRYL ESTER OF CHAULMOOGRIC ACID



Thirty grams of chaulmoogric acid were dissolved in 200 cubic centimeters of ether. Thirty grams of capryl alcohol (methyl-hexyl-carbinol or secondary octyl alcohol), which had been previously dried with anhydrous sodium sulphate and redistilled, were added to the ethereal solution of chaulmoogric acid. The flask containing the mixture was immersed in a bath of ice and water. Hydrochloric acid gas was then prepared by allowing concentrated sulphuric acid to drop from a dropping funnel into a filter flask containing fused ammonium chloride. The hydrochloric acid gas was then dried by passing it through a wash bottle containing concentrated sulphuric acid, after which the dried gas was passed for about two hours into the well-cooled ethereal solution of chaulmoogric acid and capryl alcohol. The mixture was then heated on a water bath (reflux) for three days. The reaction product was treated with water and the ester layer separated. The ester was then dissolved in ether and the solution neutralized with dilute sodium carbonate solution. A somewhat thick emulsion was formed at this stage, but this was broken up by adding a saturated solution of sodium chloride, shaking, and separating the ether layer. The ethereal solution of the ester was washed with water and separated, after which the solution was dehydrated with anhydrous sodium sulphate, filtered, and the ether removed by distillation. When the ester was distilled in vacuo it was obtained as a colorless oil with a peculiar characteristic odor. The mean boiling point was 214.6° C. (corrected) at 0 millimeter pressure. The actual yield was 14 grams, or 33 per cent, of the theoretical yield. When the formula of the ester was checked by analysis the following results were obtained:

	Carbon.	Hydrogen.
	Per cent.	Per cent.
Calculated for $C_{26}H_{48}O_2$	79.60	12.25
Found:		
I	79.45	12.20
II	79.06	12.28

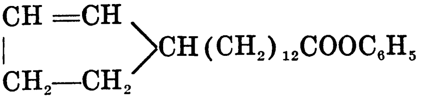
ALLYL ESTER OF CHAULMOOGRIC ACID



This ester was prepared in the same manner as the capryl ester. Thirty grams of chaulmoogric acid were dissolved in 150 cubic centimeters of ether and to the mixture 20 grams of allyl alcohol were added. The mixture was cooled, treated with hydrochloric acid gas for two hours, and heated (reflux) for three days. The reaction product was then treated with water and the ether layer separated. The ethereal solution of the ester was then treated with dilute sodium carbonate solution, then with salt solution, and washed several times with water. After separating from the water the solution was dehydrated and distilled to remove the ether. The ester was then distilled in vacuo. The purified ester was a colorless oil, which had a characteristic odor. The mean boiling point was 222.3° C. (corrected) at 5 millimeters pressure. The yield obtained was 26 grams, which is equivalent to 75.8 per cent of the theoretical yield. Analysis gave the following results:

	Carbon.	Hydrogen.
	Per cent.	Per cent.
Calculated for $C_{21}H_{36}O_2$	78.75	11.25
Found:		
I	78.60	11.61
II	78.53	11.66

PHENYL ESTER OF CHAULMOOGRIC ACID

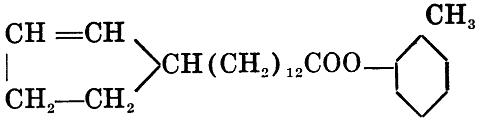


Twenty-eight grams of chaulmoogric acid were treated with 10 grams of redistilled phenol and the mixture heated in an oil (Crisco) bath to a temperature of 135°. To this mixture 8 grams of phosphorus oxychloride were then added gradually in small portions. When there was no further evolution of hydrogen chloride gas the bath was allowed to cool to a temperature of 120° and this temperature was maintained for about ten minutes until the reaction was apparently finished. The reaction product was then poured into cold water. The ester separated as an oil, which had a slightly reddish color. The mixture was neutralized with dilute potassium hydroxide solution and extracted with ether. The ether extract was washed with water and dehydrated with anhydrous sodium sulphate, after which the ether was removed by distilling. When distilled in vacuo the ester distilled over at about 233° C. (corrected) as a colorless heavy oil which solidified in the receiver. The solid ester was then crystallized from ethyl alcohol (95 per cent) and obtained as colorless, odorless crystals, which melted at 40° without decomposition. The ester was soluble in the usual common organic solvents but insoluble in water. The yield obtained was 15 grams, equivalent to 42 per cent of the theoretical yield.

Analysis gave the following results:

	Carbon. Per cent.	Hydrogen. Per cent.
Calculated for $C_{24}H_{36}O_2$	80.90	10.11
Found	80.74	10.76

ORTHO CRESOL ESTER OF CHAULMOOGRIC ACID



In preparing this ester, phosphorus oxychloride was used as a condensing agent, as in the preparation of the phenyl ester.

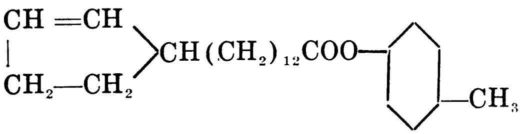
Twelve grams of freshly distilled ortho cresol were added to 28 grams of chaulmoogric acid and the mixture was heated in an oil bath to a temperature of 135°. Phosphorus oxychloride (8 grams) was added gradually to this mixture in small portions. The mixture was then heated to 150° and this temperature maintained until no more hydrogen chloride gas was given off. The temperature was then allowed to decrease to about 120°, after which the mixture was poured into water, neutralized with dilute potassium hydroxide solution, and extracted with ether. The ethereal solution was then dehydrated with anhydrous sodium sulphate and the ether eliminated by distilling. The ester was then distilled in vacuo and thus obtained as a colorless solid. The ester was further purified by treating with cold petroleum ether; some unchanged chaulmoogric acid crystallized out while the ester remained in solution. The solution was filtered to remove the chaulmoogric acid and the petroleum ether eliminated by distilling. The ester was again distilled in vacuo and obtained as a colorless liquid, which had an odor somewhat like ortho cresol. The mean boiling point was 218.8° C. (corrected) at about 0 millimeter pressure. The yield was 18.5 grams, equivalent to 50 per cent of the theoretical yield.

Analysis gave the following results:

	Carbon. Per cent.	Hydrogen. Per cent.
Calculated for $C_{25}H_{38}O_2$	81.08	10.27
Found	81.16	10.44

The ester gave no color test with ferric chloride, thus showing the absence of free cresol.

PARA CRESOL ESTER OF CHAULMOOGRIC ACID



The para cresol ester of chaulmoogric acid was prepared from para cresol and chaulmoogric acid. The procedure followed was the same as that used in preparing the ortho cresol ester.

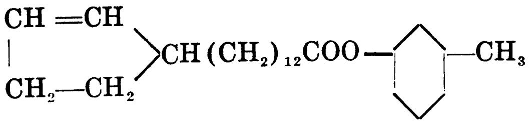
Twenty-eight grams of chaulmoogric acid were mixed with 12 grams of para cresol, and 8 grams of phosphorus oxychloride were used as a condensing agent. The para cresol ester was a colorless liquid, which had an odor resembling that of para cresol. The mean boiling point was 207.1°C. (corrected) at 0 millimeter pressure. The yield was 15.5 grams, or 42 per cent of the theoretical yield.

Analysis gave the following results:

	Carbon. Per cent.	Hydrogen. Per cent.
Calculated for $C_{25}H_{38}O_2$	81.08	10.27
Found	80.07	11.66

The percentage of carbon and hydrogen obtained by analysis of this ester did not agree quite so well with the calculated percentage of carbon and hydrogen. Although we made a special effort to purify this ester, it probably contained a small quantity of some impurity. The absence of free cresol was determined by the ferric chloride color test. To ascertain if we had really prepared an ester, a small quantity was saponified with alcoholic potassium hydroxide. The excess alcohol was removed by distilling. The residue was then acidified with dilute sulphuric acid and steam distilled. When the distillate was tested with ferric chloride solution a characteristic blue color was formed showing the presence of para cresol. The chaulmoogric acid in the residue was crystallized from alcohol (95 per cent) and identified by a melting-point determination.

META CRESOL ESTER OF CHAULMOOGRIC ACID



The meta cresol ester of chaulmoogric acid was prepared from meta cresol and chaulmoogric acid. The procedure was the same as that used in preparing the ortho cresol ester.

The materials were mixed in the proportion of 30 grams of chaulmoogric acid to 13 grams of meta cresol, after which 9 grams of phosphorus oxychloride were added. The meta cresol ester was a colorless liquid which had a cresol-like odor. The mean boiling point was 207.4°C. (corrected) at 0 millimeter pressure. The yield was 16 grams, which is 40 per cent of the theoretical yield.

Analysis gave the following results:

	Carbon. Per cent.	Hydrogen. Per cent.
Calculated for $C_{25}H_{38}O_2$	81.08	10.27
Found	80.33	11.34

The various esters we prepared are now being tested by Dr. O. Schöbl, chief of the division of biology and serum laboratory, Bureau of Science, Manila.

SUMMARY

The capryl and allyl esters of chaulmoogric acid were made by treating chaulmoogric acid with capryl and allyl alcohols, respectively, in the presence of hydrogen chloride gas.

The phenyl, ortho cresol, meta cresol, and para cresol esters of chaulmoogric acid were prepared by treating chaulmoogric acid with the proper phenol compound in the presence of phosphorus oxychloride.

ACKNOWLEDGMENT

Thanks are due Miss Paz Soriano, of the department of chemistry, University of the Philippines, for assistance in making the analyses.

THE RELATION OF TEMPERATURE AND MOISTURE TO DISEASED AND DISEASE-FREE CORN[1]

By TORIBIO VIBAR

Of the College of Agriculture, University of the Philippines, Los Baños, Laguna

ONE PLATE AND ELEVEN TEXT FIGURES

INTRODUCTION

THE PROBLEM

Diseased and disease-free corn were used in this work. By diseased corn is meant corn that showed fungous infection when dissected or tested in the seed germinator; and disease-free corn, corn that was free of fungous infection when similarly tested. Two lines of experiments were conducted; one in the laboratory, the other in the field. In the laboratory experiments, only *Diplodia* composite kernels were used, and in the field experiments, *Diplodia, Fusarium*, and scutellum-rot kernels. Therefore, diseased kernels (or seeds as used in this paper) may mean kernels or seeds chiefly infected with *Diplodia zeae* (Schw.) Lev., or may mean kernels or seeds, the chief infection of which is *Fusarium moniliforme* or scutellum rot. Scutellum rot is characterized by the blackening of the scutellum and consequent rotting of the embryo and the seed. Its cause is not yet well known.

The words "diseased" and "disease-free," used throughout this paper for lack of a better terminology, are misleading. Diseased kernels (and, consequently, diseased seedlings and plants) simply mean kernels taken from ears showing fungous infection in the germinator. There are, of course, kernels on the infected ears that may not be diseased or infected at all, in the ordinary sense of the word. Disease-free kernels are kernels from ears that were free of fungous infection. This does not mean that seedlings from disease-free kernels are not subject to infection in the period of their development later. In the use of diseased and disease-free kernels for experimental purposes, it is, however, certain at the beginning of the experiment that a certain organism is present among the kernels of the diseased, and absent among the kernels of the disease-free.

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[1] Thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Agronomy in the graduate school of the University of Illinois, 1923.

The loss of corn from corn diseases in the United States in 1919 exceeded 200,000,000 bushels, as estimated by the Plant Disease Survey Bureau of the United States Department of Agriculture.(23) Holbert and Hoffer(13) place this loss at 125,175,000 bushels, which is 4 per cent of the total crop. In 1921, the loss of corn from fungous diseases in Illinois was 10 per cent of the total crop;(36) in Indiana, Ohio, and Kentucky, it was 12 per cent. In Delaware(23) the loss was placed formerly at 3 to 5 per cent, but recent estimates have shown that this estimate was too low, and that the loss was about 15 per cent in 1920. The damage to corn caused by fungous diseases in the United States, as estimated by the plant pathologists of the country,(24) has increased from 6.39 per cent of the total crop in 1920 to 8.8 per cent in 1921.

Much study has been done on the relation of environmental factors to germination of seed and to growth and yield of crops. During the past decade, considerable emphasis has been laid on the study of plant diseases. In general, the object of the studies has been to find the effect of one or more factors of environment either on the crop alone or on the disease. The studies on the interrelation between plants and parasites as affected by the factors of environment simultaneously are very few.

PAST WORK

Effect of temperature and moisture on the germination of seeds.—Sachs(31) showed the dependence of seed germination and growth on temperature and the difference in the cardinal temperatures for the germination and growth of different species of plants. De Candolle found the same thing regarding cardinal temperatures for the germination of seeds of different species, and further demonstrated the reduction of the period required for germination as the temperature was raised. Bailey (3) reported that the lowering of temperature was correlated with the decrease in sprouting, that a constant temperature was more favorable to sprouting than a variable one of the same mean; that a comparatively small amount of water gave better results; and that soaking the seed had no influence upon sprouting. Harrington(11) showed that some kinds of seeds germinate better at alternating temperatures, and other kinds germinate as well at favorable constant temperatures as with an alternation of temperatures. Reynolds(30) and Kinzel(17) arrived at the same conclusion; namely, that the cardinal temperatures for the germination of different kinds of seeds differ, and that the higher the temperature, the less time it would take seeds to germinate.

Effect of temperature and moisture on growth.—The work of Koppen(19) on the effect of temperature on the growth of corn, that of Leitch(21) on the relation of temperature to the growth of the roots of peas, and that of Lehenbauer(20) on the growth of maize seedlings as related to temperature have shown that there are a minimum, an optimum, and a maximum temperature for growth. Lehenbauer(20) has very conclusively demonstrated that the period of observation is a very important factor in determining the temperature optimum as related to plant growth. In a field study, Brown and Garrison(8) found that, as seeding was delayed, there was a very decided increase in the rapidity of germination and rate of growth of corn. Shibata(32) showed that the growth of bamboo in Japan is closely associated with the temperature of the air. Lock,(22) on the other hand, demonstrated that in Ceylon the growth of giant bamboos is more closely associated with the humidity of the air than with the temperature. Patterson,(26) however, in his work on the effect of relative humidity and temperature on the growth of bean seedlings, concluded that the humidity of the air has no controlling influence on growth as long as the moisture of the soil is sufficient for the needs of the plant.

Effect of temperature and moisture on the yield of crops.—Hessling(12) states that the yield of corn in Argentina is positively associated with the rainfall, but negatively correlated with the temperature. Blair(6) found the same relationship between rainfall and temperature and the yield of spring wheat in the Dakotas. Smith(34) found that in Ohio the yield of corn is largely determined by the July and August rains, the half-inch rain, falling ten or twenty days before blossoming, being the most important. Following the same line of investigation, Wallace(38) expressed the idea that, while the July and August rains are the most important factor in determining the yield of corn in Ohio, they are not so in Iowa, and that each state or, rather, each county has its own specific problem regarding moisture requirement for corn.

Effect of temperature and moisture on the development of fungous diseases.—Johann and others(14) found that *Diplodia zeae* (Schw.) Lev. attacks corn seedlings under very high and very low moisture conditions at temperatures of from 24 to 32° C. They state that at 28° C., when the soil was wet, 63 per cent of the plants showed severe browning of the mesocotyles. Norton(25) found the fungus causing the swelling disease of peach to become more active as soon as the severity of the winter was over, and held that the epidemic caused by this disease is regulated by the rains and dampness of the summer months. Weston(39) concluded from his work on the Philippine downy mildew of corn that the conidia of this fungus are produced only at night when the leaves are covered with a layer of moisture. Stevens(35) found that the development of *Endothia parasitica* has no relation to the amount and frequency of rainfall, but that the growth of this fungus is closely connected with the duration of favorable temperatures for growth. Balls(4) maintains that the rate of growth of the hyphæ of the sore-shin fungus is in accordance with Van't Hoff's Law. Klebs,(18) Ames,(2) Brooks and Cooley,(7) Reddick,(29) Gilman,(10) Jones and Tisdale,(15) Peltier,(28) and Melhus and Durrel(24) have shown that there are a minimum, an optimum, and a maximum temperature for the development of fungi causing plant diseases, and that the cardinal temperatures for the development of these fungi vary with the kind.

OBJECT OF THE PRESENT WORK

Of the two sets of experiments reported here one set was conducted in the laboratory, and the other set in the field. The work pursued covered the effect of temperature, moisture, gases, and dry heat on diseased and disease-free corn and the effect of temperature, hydrogen ion concentration, and gases on pure cultures of *Diplodia zeae* (Schw.) Lev. In this paper, only the effect of temperature and moisture on diseased and disease-free corn is discussed, the other parts of the work being reserved for future publication.

TIME AND PLACE OF THE PRESENT WORK

The present work was conducted in the University of Illinois, the laboratory part of it in the plant physiology laboratory, during the latter part of the college year 1921–1922 and the early part of the college year 1922–1923. The field observations were made in the summer of 1922 from the plantings made by the division of crop production of the agronomy department on the south farm.

MATERIALS AND METHODS

THE LABORATORY EXPERIMENTS

The kernels used for these experiments were taken from the harvest of the previous year; the diseased and the disease-free kernels were preserved in glass jars. As germinating media, rag dolls, brown silt loam, and sand were used. In the experiments where sand or soil was used, the percentage of moisture means the percentage of saturation, the maximum amount of water the sand or the soil can hold after the excess has been drained off being taken as 100 per cent. The temperature chambers used for the laboratory experiments are cases fitted with triple glass walls. The temperature in these cases is maintained to within 0.5° C. In these experiments, the period covered only the germination of the kernels and the growth of the seedlings. For the sake of a more comprehensive comparison, it was necessary to adopt relative figures in determining the differences in the growth of the fungus as affected by temperature; 100 represents development of mycelium covering the kernels entirely and spreading extensively; 50, medium development; 10, slight; 5, very slight; 2.5, negligible; and 0, no development. The particular methods of procedure will be discussed in the report of each experiment.

THE FIELD EXPERIMENTS

The corn used for the experiments was planted on plot north 200 of the agronomy field on the south farm. This field slopes southward gently, and is divided into east and west plots. The east plots were fertilized with 45 tons of well-rotted manure, 1.5 tons of lime, and 1,500 pounds of rock phosphate per acre, applied every three years before the potato crop in the rotation, which is potatoes, sweet clover, and corn. All the plots were treated alike throughout the course of the experiment. Four plantings were made, on May 4, May 13, May 22, and May 31. In each planting there were at least three rows, 8 rods long, of each kind of diseased and disease-free corn planted 75 inches in all directions with two kernels to the hill. Every alternate plot was a check plot; that is, a plot planted to disease-free corn. Records were made of the rate of growth, final heights of plants, production of suckers and brace roots, leaning and fallen plants, yield, and smut infection of diseased and disease-free corn.

THE GROWTH MEASUREMENTS

A good index of growth is the weight of the plant. As this index cannot be used to indicate the growth of the plant at different stages of development, it is necessary to use an external character of the plant to measure growth. Some of these external characters are the height to the tip of the longest leaf, the height to the tip of the youngest leaf, and the height to the highest leaf base. Large numbers of seedlings were grown in the laboratory under uniform conditions. Every week, for five weeks after the kernels were planted, several seedlings were harvested, weighed individually, and the external characters mentioned determined. It was found that the height to the tip of the longest leaf was more closely correlated with the weight of the plant than was any other character measured. No difficulty, either in the field or in the laboratory, was encountered in measuring this character; but attempts to measure from a fixed point at the base of the plant to the highest leaf base or to the tip of the youngest leaf were met by unusual difficulties. The height of the highest leaf base does not increase fast enough, especially in the early development of the plant, in proportion to the mass of growth. The height to the tip of the youngest leaf cannot be safely relied upon, as many young leaves emerge together, especially in the late planting. It was further found that sometimes the height to the tip of the youngest leaf was less than the height to the tip of the young one in the previous measurement. It was, therefore, decided that, as a criterion of growth, the height to the tip of the longest leaf should be used. Pearl and Surface(27) used this method in their work on the growth and variation in corn.

THE CLIMATIC RECORDS

Records of the air temperature and of the soil temperature at different depths in the field were made. The temperature of the air was very variable, as was also the temperature close to the surface of the soil. The temperature at depths of 6, 12, and 24 inches was less subject to variation. That at a depth of 24 inches was practically unaffected by the fluctuation of the temperature of the air. It rose steadily in a straight line as the season advanced. In the study on the relation of temperature (minimum, mean, and maximum), rainfall, and relative humidity of the air to growth, the climatic records taken by the College of Agriculture and Experiment Station were found more reliable and convenient, and were, therefore, used generally.

EXPERIMENTS AND RESULTS

THE LABORATORY EXPERIMENTS

a. Germination and growth of diseased and disease-free corn as affected by temperature.—Ten diseased kernels and ten disease-free kernels were placed in a rag doll, the diseased kernels on the left side of the rag doll and the disease-free kernels on the right side, about 8 inches from each other (Plate 1). After the dolls were rolled on wire cores, they were placed in a pan of water to soak for about three minutes. Then they were transferred to 2-gallon fruit jars loosely covered, and the jars were placed in the different temperature chambers, duplicate jars to each chamber. A set of two jars was kept at room temperature. After one week, the dolls were taken out of the different temperature chambers and the percentage of germination, the growth of the seedlings, the relative growth of the mycelium of the fungus, and the number of seeds and seedlings that had rotted determined. The average percentages of germination were 85, 85, 85, 70, 90, and 80 for the diseased kernels, and 100, 100, 90, 95, 90, and 95 for the disease-free kernels at the 30, 25, room, 20, 15, and 10° C. temperatures, respectively. In the same temperature order, the average lengths of the plumules, in millimeters, were 133.5, 134.5, 101.5, 96, 34.5, and 8.2 for the diseased kernels, and 189.5, 166.5, 139.5, 98.5, 35.5, and 9.8 for the disease-free kernels. The relative development of the mycelium was 100, 100, 95, 65, 15, and 7.5 on the diseased kernels, and 45, 27.5, 40, 20, 2.5, and 1.2 on the disease-free kernels. The numbers of kernels and seedlings that had rotted were 10, 10, 10, 7.5, 2, and 2 of the diseased, and 5, 2, 3.5, 2, 0.5, and 0 of the disease-free kernels, respectively. *Diplodia* constituted practically all the fungous growth on the diseased kernels, and *Rhizopus* on the disease-free. The illustration, Plate 1, shows the results of exactly the same kind of experiment as this one, but the kernels used were taken from the 1922 harvest on the south farm. Rise in temperature increases the rate of growth of diseased and disease-free corn and the development of the *Diplodia* mycelium. More kernels and seedlings rot at higher temperatures.

b. Effect of fluctuating temperatures on diseased and disease-free corn.—Another series of dolls was prepared and subjected to fluctuating temperatures. Two sets of duplicate dolls were exposed at 30 to 20° C. and at 20 to 30° C.; that is, the set exposed at the 30 to 20° C. was first placed in the 30° C. chamber, and the set exposed at the 20 to 30° C. was first placed in the 20° C. chamber. The dolls then were shifted from one temperature chamber to the other every twenty-four hours for eight days. Other sets of dolls were subjected to 25 to 15° C., 15 to 25° C., 20 to 10° C., and 10 to 20° C. As can be seen, these fluctuating temperatures give means of 25, 20, and 15° C., respectively. To compare the effect of these fluctuating temperatures with the effect of uniform temperature of the same mean, the dolls in the 25, 20, and 15° C. chambers in the previous experiment were returned to their respective chambers for one more day after the record was taken, in order that the length of their exposures to these temperatures might be the same as that at the fluctuating temperatures. After eight days, the dolls were taken out and records taken as before. The average percentages of germination in the 30 to 20, 20 to 30, 25, 25 to 15, 15 to 25, 20, 20 to 10, 10 to 20, and 15° C. were 80, 90, 85, 75, 75, 70, 75, 75, and 85 for the diseased kernels, and 100, 95, 100, 95, 100, 90, 90, 100, and 95 for the disease-free kernels, respectively. At the same temperature order, the average lengths of the plumules, in millimeters, were 69, 71, 143, 71, 43, 104, 7.5, 7.5, and 50 for the diseased kernels, and 82, 91, 169, 88, 69, 159, 7.5, 7.5, and 46 for the disease-free. The relative growth of the mycelium of the fungus was 90, 100, 100, 70, 75, 65, 15, 10, and 15 on the diseased kernels, and 7.5, 50, 35, 20, 25, 20, 2.5, 2.5, and 3.7 on the disease-free kernels. The numbers of the kernels that rotted were 6, 10, 10, 5.5, 9, 9, 4, 2, and 2 for the diseased kernels, and 0.5, 5.5, 4.5, 1.5, 3.5, 3.5, 0, 0.5, and 1 for the disease-free kernels, respectively. The same results were obtained in this experiment regarding the relation of temperature to the rate of growth of diseased and disease-free corn, the development of *Diplodia* mycelium, and the number of kernels and seedlings that rotted. Uniform temperature is more favorable to growth of corn than is alternating temperature of the same mean.

Another experiment was conducted to determine the effect of fluctuating temperatures. Diseased and disease-free kernels were planted in sand containing 20, 40, and 60 per cent water.

Petri dishes of 175 cubic centimeters capacity were used as containers. They were placed under inverted fruit jars of 2 liters capacity. One diseased kernel and one disease-free kernel were planted in each dish 1.5 inches from each other. To simulate the diurnal change of temperature, the cultures were placed in the 30° C. chamber in the daytime. At night, they were placed, respectively, in the 10, 15, 20, and 25° C. chambers. One set of cultures was kept at 30° C. None of the diseased kernels germinated. After one week, the heights of the disease-free seedlings were measured, showing the results presented in Table 1.

TABLE 1.—*Effect of fluctuating temperature on the growth of disease-free corn.*

Temperature.	Percentage of moisture.		
	20	40	60
°C.	*mm.*	*mm.*	*mm.*
30 [a]	250	282	320
30 to 25	128	238	251
30 to 20	90	140	156
30 to 15	33	95	141
30 to 10	31	50	58

[a] Constant.

The roots were carefully washed. No infection above or below the surface of the sand was noted. The diseased kernels that failed to germinate were covered with *Diplodia* mycelium chiefly. The mass of the mycelium growing on the surface of the sand above the diseased kernels is shown by the comparison presented in Table 2.

TABLE 2.—*Effect of fluctuating temperature on the development of Diplodia mycelium.*

Temperature.	Percentage of moisture.		
	20	40	60
°C.			
30 [a]	Slight	Not much	Much.
30 to 25	do	Much	Do.
30 to 20	None	None	Slight.
30 to 15	do	Slight	Do.
30 to 10	do	None	None.

[a] Constant.

In this experiment a higher rate of growth of seedlings was obtained at high temperature and high moisture condition, as shown in Table 1. The rate of development of *Diplodia* mycelium as related to temperature and moisture parallels the rate of growth of the seedlings generally, as shown in Table 2.

c. Germination and growth of diseased and disease-free corn, as affected by different amounts of water.—Four galvanized iron pans, 12 inches long, 5 inches wide, and 6 inches deep, were half filled with a moist mixture of sand and sphagnum. Two hundred cubic centimeters of water were added to pan 2, 400 cubic centimeters to pan 3, and 800 cubic centimeters to pan 4. Pan 1 received no additional water. Pan 1 was moist and pan 4 was wet. The moisture content of the sand and sphagnum in pans 2 and 3 was intermediate. The moisture content of the four pans was kept constant by replacing every Monday, Wednesday, Friday, and Saturday the water lost through evaporation and transpiration. In each pan five diseased kernels were planted at one end and five disease-free kernels at the other. The pans were kept under greenhouse conditions throughout the experiment. No germination took place in the first three days after planting. The numbers of diseased kernels that germinated were 5, 3, 5, and 3, and the numbers of disease-free kernels were 5, 5, 4, and 5 in pans 1, 2, 3, and 4, respectively. All the seedlings in pans 1, 2, and 3 emerged on the fourth day. Those in pan 4 did not all emerge until the fifth day. Growth measurements were taken every Monday, Wednesday, and Friday for thirty days, at the end of which time the average heights of the seedlings from the diseased kernels were 655, 582, 633, and 603 millimeters, and those from the disease-free kernels were 639, 598, 695, and 556 millimeters in pans 1, 2, 3, and 4, respectively. Practically no difference was observed in the rate of germination of diseased and disease-free kernels, and in the rate of growth of diseased and disease-free seedlings. High moisture condition in the germinating media retarded germination decidedly.

d. Effect of diseased kernels on disease-free kernels as affected by temperature and moisture.—Three diseased kernels and three disease-free kernels were planted in tall preserving jars. Sand containing 20, 40, and 60 per cent moisture was used. The jars were kept in the different temperature chambers for one week, except those in the 10° C. case, which had to be kept in that case for a month because of slow germination and growth. All the disease-free kernels germinated at 10 to 30° C. in the 20, 40, and

60 per cent moisture cultures. Of the diseased kernels, one seed germinated at 30° C., none at 25° C., one at 20° C., two at 15° C., and two at 10° C. In the 40 per cent moisture, two, one, one, none, and two kernels germinated; and in the 60 per cent moisture, two, one, two, two, and two kernels germinated in the 30, 25, 20, 15, and 10° C. chambers, respectively. The kernels that failed to germinate were taken out and examined. The diseased kernels had rotted and were covered with *Diplodia* mycelium. All the seedlings from the disease-free kernels at 30 and 25° C. in the sand containing 20, 40, and 60 per cent water were infected except one in the 60 per cent moisture. At 20° C. only one seedling was infected in the 20 per cent moisture, and none in the 40 or the 60 per cent. The seedlings at the 15 and the 10° C. were found free of infection. Infection in all cases took place in the mesocotyle, which is very tender and soft.

The diseased kernels covered with mycelium in the experiment immediately preceding were planted in fresh sand saturated to 20, 40, and 60 per cent of its water-holding capacity. One dead kernel was planted in each jar. One diseased kernel was planted at one side of this dead kernel and one disease-free kernel at the opposite side. The cultures were placed in the different temperature chambers for one week. None of the diseased kernels germinated. All the disease-free kernels germinated and grew. The shoots of the seedlings of the disease-free kernels were measured at the end of the experiment and gave the results presented in Table 3.

TABLE 3.—*Effect of uniform temperature on the growth of disease-free corn.*

Temperature.	Percentage of moisture.		
	20	40	60
°*C.*	*mm.*	*mm.*	*mm.*
30	227	228	294
25	84	154	251
20	88	94	112
15	42	72	100
10 [a]	32	49	58

[a] One month.

On the surface of the sand above the diseased kernels, *Diplodia* mycelium developed. The relative extent of this development, taking 100 as the greatest, can be seen by the comparison presented in Table 4.

TABLE 4.—*Effect of uniform temperature on the relative development of Diplodia mycelium.*

Temperature.	Percentage of moisture.		
	20	40	60
°C.			
30	10	25	0
25	50	100	60
20	0	5	10
15	0	2	2
10 [a]	0	0	0

[a] One month.

It is significant in this connection that no infection of the seedlings from the disease-free kernels took place in one week at 30, 25, 20, and 15° C. and during one month at 10° C. in spite of their contact with the diseased, rotted kernels.

e. Germination and growth of diseased kernels of different degrees of infection.—Every alternate kernel from the butt to the tip of an ear infected with *Diplodia* was planted in sand containing 50 per cent moisture. The germinating pan was kept covered for one week. At the end of one week it was necessary to uncover the pan in order to allow the seedlings to grow freely. From one row, twenty-four kernels were planted in the sand and from the other row, twenty-three kernels. The kernels were numbered consecutively from the tip of the ear. The seedlings were allowed to grow for seventeen days. Kernels 1 to 13 in the first row, and kernels 1 to 14 in the other row, failed to germinate. Kernels 14 and 15 in the first row germinated; the seedlings grew for a few days, and then succumbed to *Diplodia.* The seedling from kernel 15 in the other row attained a height of 15 millimeters, and died on the fourteenth day after planting. The total heights reached by the seedlings from kernels 16, 17, 18, 19, 20, 21, 22, 23, and 24 were 285, 295, 275, 265, 265, 253, 320, 254, and 310 millimeters, respectively, for the first row, and 255, 295, 245, 233, 236, 225, 250, and 240 millimeters for the second row. The seedlings were apparently growing normally when the experiment was closed. The result of this experiment shows that infection of *Diplodia* was confined to the kernels at the tip end, and that the degree of infection of the kernels varies.

f. Effect of temperature on the germination and growth of corn of different degrees of infection.—After the extreme tip and butt kernels had been removed, the kernels from an ear of corn infected with *Diplodia* were placed in rag dolls, one row of forty seeds to each rag doll. The kernels were numbered consecutively from the tip of the ear, and were placed in the rag doll in the same order as when on the ear. After the seeds had been rolled in the rag dolls, the dolls were placed in a pan of water to soak for about three minutes and then transferred to loosely covered Mason jars and placed in the different temperature chambers, two jars to each chamber. A set of two jars was kept at room temperature. After one week the dolls were opened, and record of the growth of the seedlings and of the fungus was taken. The experiments in the 30, 25, room, and 20° C. temperatures were closed at the end of one week. The experiment in the 15° C. was allowed to run for two weeks, and that in the 10° C. for four weeks. The average percentages of germination at the 30, 25, room, 20, 15, and 10° C. temperatures were 61, 54, 60, 68, 68, and 67, respectively. The relative mycelial development was 100 at 30° C., 97.5 at 25° C., 90 at room temperature, and 85 at 20° C. for one week. At 15° C. the mycelial development was 25 in the first week and 97.5 at the end of the second week. At 10° C. in one week only two kernels in each rag doll germinated. The development of the *Diplodia* mycelium was visible at this temperature for the same period. At the end of two weeks, the length of the plumules of the kernels that germinated at 10° C. averaged only about 5 millimeters, and the relative mycelial development was about 20. At the end of the third week, the seedlings had not made much progress at this temperature, but the mycelium showed considerable development, in some cases covering whole seeds. Only eleven seedlings in one rag doll had not rotted, and nine in the other. At the end of four weeks the relative mycelial development was about 70. Seeds and seedlings 1 to 33 had rotted. Only the growth of seedlings 34 to 40 was measured, as these seedlings were the only ones showing normal development. The average length of these seedlings was 12 millimeters. The numbers of seeds and seedlings that had rotted in one week in the 30, 25, room, and 20° C. temperature were 40, 34.5, 35, and 26.5, respectively. At 15° C. the number was 25.5 at the end of the first week and 35.5 at the end of the second week. At 10° C. twenty-three seeds and seedlings rotted at the end of the second week, and thirty-three at the end of the fourth week. *Diplodia* infection takes place at temperatures of from 10 to 30° C. The infection is more severe at higher temperatures. At 10° C. *Diplodia* mycelium develops faster than the corn.

g. Effect of moisture on the germination and growth of corn of different degrees of infection.—Kernels from the same ear as that used in the experiment immediately preceding were planted in moist and wet soil 2.5 inches apart, and the rows 5 inches apart with 10 kernels to the row. The kernels were planted in the soil in the same order as when in the rows on the ear. Two rows of kernels were planted in the moist soil and two rows in the wet soil. The moisture of the soil was maintained by watering at least once a day. The seedlings showed little development at the end of the first week. Measurement of growth was started at the end of the second week from the planting time, and continued every week thereafter. Fifty-seven per cent was the average of germination of the kernels in the moist soil, and 53 per cent that of kernels in the wet soil. Practically all the kernels that failed to germinate were the ones from the tip to the middle of the ear. With the exception of three or four kernels, all the kernels from the butt end to the middle of the ear germinated, and grew normally for six weeks. Some kernels from the tip end to the middle of the ear germinated. About four in each row developed normally, as did the kernels at the butt. Some seedlings succumbed just after germination; others attained a height of a few millimeters, withered, and died or rotted; the diseased seedlings in the moist soil withered and died and those in the wet soil rotted. Apparently the death of the seedlings occurred earlier in the wet soil than in the moist soil. There was practically no difference in the height reached by the seedlings in the moist and in the wet soil at the end of the experiment.

h. Rate of germination of disease-free corn as affected by temperature and moisture.—Brown silt loam soil taken from the south farm was used as the medium, Yellow Dent Corn 176–A as subject, and jelly glasses of 200 cubic centimeters capacity as containers. Different portions of soil were saturated to 10, 20, 30, and 40 per cent of their water-holding capacity, respectively. The soil was then transferred to the container, and compacted with the compacting machine to give the different cultures the same degree of compactness. Five kernels were planted in each of duplicate cultures, and the cultures were then placed in the different temperature chambers. A set of cultures was kept at room temperature. Effort was made to minimize the loss of water through evaporation by transferring the soil to sealed containers while the compacting was going on. Observation on the rapidity of germination was made daily. No kernels germinated in the soil containing 10 per cent moisture at any of the temperatures tested. In the soil containing 20 per cent moisture no kernels germinated at 10° C.; at 15° C. 10 per cent of the kernels germinated in fourteen days and 20 per cent in twenty-one days; at 20° C. 10 per cent of the kernels germinated in five days, 20 per cent in twenty-one days, and 30 per cent in twenty-eight days; at room temperature 30 per cent of the kernels germinated in six days, 60 per cent in fourteen days, and 70 per cent in twenty-one days; at 30° C. 70 per cent germinated in five days and 80 per cent in six days. In the soil containing 30 per cent moisture, at 10° C. 20 per cent of the kernels germinated in fourteen days, 60 per cent in twenty-one days, and 70 per cent in forty-two days; at 15° C. 80 per cent of the kernels germinated in fourteen days and 100 per cent in twenty-one days; at 20° C. 20 per cent of the kernels germinated in four days, 90 per cent in five days, and 100 per cent in seven days; at room temperature 30 per cent of the kernels germinated in three days and 100 per cent in four days; and at 30° C. the germination of the seed was 100 per cent in three days. In the soil containing 40 per cent moisture, at 10° C. 40 per cent of the kernels germinated in twenty-one days, 70 per cent in twenty-eight days, 80 per cent in thirty-five days, and 90 per cent in forty-two days; at 15° C. 20 per cent germinated in seven days and 100 per cent in fourteen days; at 20° C. 50 per cent germinated in four days and 100 per cent in five days; at room temperature 30 per cent germinated in three days and 100 per cent in four days; and at 30° C. 100 per cent of the kernels germinated in three days. Twenty per cent, therefore, is the critical moisture content of brown silt loam. At this saturation, the kernels cannot germinate at 10° C., but at 15 to 30° C. more and more kernels are able to take water from the soil and germinate as the temperature rises. The rapidity of the rate of germination caused by high temperature is very evident from the experiment. Water also plays an important part. At the same temperature, increase in the moisture content of the soil, as far as this experiment is concerned, also accelerated and increased the rate of germination. In this experiment, the point of germination was taken when the plumule emerged on the surface of the soil. In the cultures containing a low percentage of moisture, especially those at lower temperatures, some seeds germinated but failed to come up. These seeds were all covered with mycelium. At the end of each experiment, the average heights of the seedlings were taken. These average heights were found to be as shown in Table 5.

TABLE 5.—*Effect of temperature and moisture on the growth of corn seedlings.*

Temperature.	Age of seedlings.	Moisture of culture.	Height of seedlings.
°C.	*Days.*	*Per cent.*	*cm.*
10	19	30	2.70
10	19	40	4.35
15	29	30	2.22
15	29	40	6.79
20	11	30	5.64
20	11	40	8.29
Room	8	20	0.40
Room	8	30	6.43
Room	8	40	10.16
30	10	20	5.29
30	10	30	10.94
30	10	40	13.92

Table 5 shows that the effect of moisture on the growth of the seedlings is as significant as is the effect of temperature.

i. Rate of germination of diseased corn as affected by temperature and moisture.—Three lots of sterilized white quartz sand were moistened to 20, 40, and 60 per cent of their water-holding capacity, respectively. The sand was then transferred to Petri dishes of 250 cubic centimeters capacity. Five diseased kernels were planted in each dish, and the cultures were placed in the different temperature chambers. Observation on the rate of germination was made daily. In the cultures containing 20 per cent moisture, at 10° C. 40 per cent of the kernels germinated in fourteen days. No further germination took place after fourteen days. At 15° C. 40 per cent of the kernels germinated in five days; at 20° C. also 40 per cent of the kernels germinated in five days; at 25° C. 80 per cent of the kernels germinated in three days; and at 30° C. 60 per cent of the kernels germinated in three days. In the cultures containing 40 per cent moisture, 20 per cent of the kernels germinated in fourteen days at 10° C.; at 15° C. 20 per cent germinated in five days; at 20° C. 40 per cent germinated in three days; and at 30° C. 60 per cent germinated in three days. In the cultures containing 60 per cent moisture, at 10° C. 40 per cent of the kernels germinated in fourteen days; at 15° C. 60 per cent in five days; at 20° C. 40

per cent in five days; at 25° C. 60 per cent in three days; and at 30° C. 60 per cent in three days. No further germination took place after the expiration of the number of days mentioned. The percentage of germination of *Diplodia* composite kernels is very low in this experiment; it was always so in all the experiments where this kind of kernel was used. In this experiment, while rise in temperature reduced the period required for germination, the results show that it had no decided effect in increasing the percentage of germination.

In all the laboratory experiments, rise in temperature increased the rapidity of germination and the rate of growth of the seedlings, both of diseased and of disease-free corn. In the sand and soil cultures, increase in moisture gave significant increases in the rate of growth of the seedlings, as far as the experiments reported herein are concerned. High moisture condition in the germinating media retarded germination slightly. This retardation was especially significant in the cultures at low temperatures. Neither temperature nor moisture seems to have any effect on the percentage of germination. The development of *Diplodia* mycelium is also increased by the rise in temperature. The number of seeds and seedlings rotting is large at high temperatures. High moisture condition generally favored the development of *Diplodia.*

FIELD EXPERIMENTS

a. The effect of date of seeding on the growth of diseased and disease-free corn.—Twenty days after each planting, and until the plants ceased growing, growth measurements of plants on the diseased and the disease-free plots were taken. The measurements were made from a fixed point on the surface of the soil to the tip of the longest leaf. Measurements were also made to the tip of the tassel as soon as the tassels appeared. Twelve plants, picked at random, apparently representative of the plants in each plot, were measured, making seventy-two plants for each planting, and two hundred eighty-eight plants for all the plantings. All the plants, the growth of which were measured, were in the east plots. The growth measurements were made every third day in the afternoon, beginning at 1 o'clock. These growth measurements constitute one table of figures for each plot, six tables for each planting (three for diseased and three for disease-free corn), and twenty-four tables for all the plantings. The growth measurements of the plants in each plot were averaged, reducing the number of tables to four, one table for each planting. Then the three-day growth increments were determined. As there were three checks in each planting, the average growth increments of the three checks were again averaged. Graphs were constructed from the growth increments; the relation of the growth increments to the rainfall, humidity of the air, and temperature of the air was determined and is discussed under the general discussion of the results of these experiments. For the sake of simplicity, the data are given in graphic form rather than in tables. (See figs. 3 to 11.

b. Yield of diseased and disease-free corn as affected by different dates of planting.—The crop was harvested by the division of crop production of the department of agronomy, and the yields of the different plots were determined. Table 6 shows the yields of the diseased and the disease-free corn of the plots where the growth measurements were taken. These plots are in the northeast section of plot north 200. They are a part of a much larger plot devoted to investigation on the effect of dates of seeding on diseased and disease-free corn. In Table 7 are given the average yields of all the plots under this investigation.

TABLE 6.—*Effect of date of seeding on the yield of diseased and disease-free corn (northeast plots).*

Kind of seed.	Yield in east plots.	Yield in west plots.
	Bu.	*Bu.*
Scutellum rot:		
First planting	56.9	50.5
Second planting	46.1	44.4
Third planting	42.8	40.4
Fourth planting	39.4	36.3
Diplodia:		
First planting	40.9	43.5
Second planting	30.4	38.8
Third planting	31.3	34.7
Fourth planting	24.5	24.4
Fusarium:		
First planting	54.7	51.9
Second planting	48.4	50.7
Third planting	49.4	44.8
Fourth planting	44.0	39.0
Disease-free:		
First planting	60.9	56.2
Second planting	54.1	51.5
Third planting	56.0	51.0
Fourth planting	47.5	48.7

TABLE 7.—*Effect of date of seeding on the yield of diseased and disease-free corn (all plots).*

Kind of seed.	Yield in east plots.	Yield in west plots.
Scutellum rot:	*Bu.*	*Bu.*
First planting	63.9	54.7
Second planting	54.3	55.5
Third planting	48.2	44.5
Fourth planting	47.5	40.0
Diplodia:		
First planting	43.9	40.9
Second planting	35.5	36.9
Third planting	33.9	35.7
Fourth planting	33,5	29.5
Fusarium:		
First planting	57.6	48.6
Second planting	54.1	54.5
Third planting	52.0	49.0
Fourth planting	54.3	44.1
Disease-free:		
First planting	65.6	52.6
Second planting	59.8	56.8
Third planting	59.2	53.1
Fourth planting	56.6	49.4

It will be noted from these two tables that there was a general reduction in yield in all the diseased and disease-free plots as the planting was delayed. The difference in yield between the second and the third plantings is not so significant as is that between the first and the last plantings. There was a more-significant reduction in yield on the *Diplodia* plots than on either the *Fusarium,* the scutellum rot, or the disease-free plots. This reduction in yield, as can be seen in Tables 6, 7, and 11, is due more to the reduction in stand of the plants than to the reduction in size of the individual ears. In general, the difference in yield between the east and the west plots is slight.

c. Effect of date of seeding on variability in height of diseased and disease-free corn.—In as much as it was not possible to measure the growth of all the plants in each plot in the east plots, the heights of practically all the plants in these plots were measured just after growth ceased. The mean, the standard deviation, the coefficient of variability of the heights of the plants measured, and the probable error of these constants were determined. These determinations are given in Table 8.

TABLE 8.—*Variability in height of diseased and disease-free corn.*

Condition of seed.	Mean.	Standard deviation.	Coefficient of variability.
FIRST PLANTING.			
	Inches.	*Inches.*	
Scutellum rot	101.73±.3574	7.12±.2563	6.99±.2521
Disease-free	102.80±.3170	6.06±.2181	5.89±.2124
Diplodia	104.40±.4486	8.17±.4565	7.82±.4422
Disease-free	103.17±.3170	6.28±.2260	6.08±.2188
Fusarium	104.10±.4114	8.19±.2948	7.86±.2829
Disease-free	101.73±.3439	6.82±.2447	6.80±.2484
SECOND PLANTING.			
Scutellum rot	102.54±.3586	7.03±.2530	5.52±.1987
Disease-free	104.77±.3163	6.20±.2232	5.91±.2127
Diplodia	101.96±.5965	8.88±.5949	8.17±.5829
Disease-free	104.76±.3275	6.42±.2311	6.12±.2203
Fusarium	101.81±.3678	7.20±.2592	7.07±.2535
Disease-free	103.31±.3299	6.45±.2330	6.24±.2248
THIRD PLANTING.			
Scutellum rot	102.73±.4076	8.13±.2926	7.91±.2847
Disease-free	103.95±.3612	7.08±.2548	7.77±.2797
Diplodia	103.46±.5183	7.86±.5115	7.60±.4940
Disease-free	104.61±.3544	6.92±.2491	6.61±.2379
Fusarium	105.54±.4030	7.90±.2848	7.84±.2822
Disease-free	104.17±.4418	8.66±.3117	8.31±.2991
FOURTH PLANTING.			
Scutellum rot	105.23±.4476	7.42±.4526	7.05±.4270
Disease-free	106.56±.4397	7.98±.4382	7.49±.4119
Diplodia	102.21±.6269	8.31±.6232	8.13±.6097
Disease-free	103.20±.4395	7.99±.4372	7.74±.4147
Fusarium	101.72± 4336	7.87±.4328	7.73±.4141
Disease-free	104.28±.4441	8.08±.4449	7.76±.5115

It appears from this table that the heights of the plants in the last two plantings have a greater variability than have those in the first two plantings. The diseased plants, especially the *Diplodia* plants, were more variable in height than were the disease-free plants. There is no consistent difference in the total heights reached by the diseased and the disease-free plants in the four plantings.

d. Indications of diseased condition; production of suckers and brace roots.—In corn, the production of suckers and brace roots, the curling of leaves, tip-burnt leaves, and deficient chlorophyll production have been mentioned or assumed by investigators and farmers as indications of a diseased condition. The curling and the drying of leaves may indicate root destruction caused by root-rot diseases. A general survey and count of the plants with curling leaves in all the plots under observation showed that there were as many plants with curling leaves among the plants on the diseased as on the disease-free plots. A similar survey of the stalks toppling over gave the same results. While the curling and the drying of leaves and the toppling over of the stalks may indicate a diseased condition of the roots, it is believed that they cannot be taken as conclusive proofs of root attack by root-rot parasites, especially when the weather conditions are adverse to the development of the corn plant. This is also true of tip-burnt leaves and drying of the lower leaves. Tip-burnt leaves in the young stage may show not only root destruction, but also bacterial infection. A few plants on the diseased plots were observed to have been decidedly infected with root rot. The production of chlorophyll in all of these plants was imperfect. The leaves of these plants were characterized by long, white stripes and broken chlorophyll lines. There is a wide variation in the degree of greenness in the leaves of corn. Whether this phenomenon is due to heredity, to the influence of environment, or to disease remains to be learned.

At the time the plants ceased to grow, each plant in the east and the west plots was examined individually. The number of suckers produced by each plant was counted, as well as the number of plants producing brace roots on the first, second, third, fourth, and fifth nodes above the surface of the soil. Of the plants with suckers between 90 and 95 per cent had one or two suckers. Some produced three. Less than 1 per cent of the sucker-producing plants had four suckers. The plants on the *Diplodia* plots produced slightly more suckers than did the plants on the other diseased plots and on the disease-free plots. There was no significant difference between the number of plants producing suckers on the *Fusarium*, scutellum-rot, and the disease-free plots in any of the four plantings. About 90 per cent of the brace-root-producing plants had brace roots on the first, second, and third nodes above the surface of the soil. Very few plants had brace roots on the fourth node. In the east and the west plots there were only four plants found to produce brace roots on the fifth node. No significant difference was noted in the production of brace roots by plants on the diseased and on the disease-free plots in any of the four plantings. In general, the leaning and fallen plants had more brace roots than did the erect ones. Table 9 gives the percentage of plants producing suckers and brace roots in the east plots, and Table 10 gives that for the plants in the west plots.

TABLE 9.—*Percentage of plants producing suckers and brace roots (east plots).*

Condition of seed.	Plants with suckers.		Plants with brace roots on second and upper nodes.	
	Erect.	Leaning and fallen.	Erect.	Leaning and fallen.
FIRST PLANTING.				
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Scutellum rot	37.33	30.64	46.00	52.22
Disease-free	41.72	29.72	30.07	56.75
Diplodia	45.05	49.12	40.30	71.92
Disease-free	28.85	41.17	37.27	60.00
Fusarium	38.83	31.30	80.45	59.13
Disease-free	40.11	31.94	18.60	43.05
SECOND PLANTING.				
Scutellum rot	46.16	30.37	60.13	78.48
Disease-free	47.96	45.00	56.09	74.16
Diplodia	60.22	100.00	59.09	66.66
Disease-free	44.68	45.45	60.29	87.14
Fusarium	44.74	38.52	43.85	70.49
Disease-free	49.65	39.53	61.46	82.94
THIRD PLANTING.				
Scutellum rot	44.44	40.00	56.71	38.57
Disease-free	38.41	28.76	50.99	82.19
Diplodia	64.70	47.30	35.29	68.42
Disease-free	40.90	29.62	46.10	85.18
Fusarium	47.95	47.05	50.87	61.76
Disease-free	48.80	51.28	51.61	64.10
FOURTH PLANTING.				
Scutellum rot	60.75	00.00	40.62	100.00
Disease-free	56.70	62.50	42.29	62.60
Diplodia	64.86	66.66	40.54	50.00
Disease-free	52.00	30.00	45.33	100.00
Fusarium	39.15	75.00	38.55	41.65
Disease-free	37.50	20.81	37.73	37.50

Examination of the figures in Tables 9 and 10 shows that no conclusive statement can be made regarding the difference in the production of suckers and brace roots by diseased and by disease-free plants. Nor can any definite statement be made regarding the effect of planting on the production of suckers and brace roots.

TABLE 10.—*Percentage of plants producing suckers and brace roots (west plots).*

Condition of seed.	Plants with suckers.		Plants with brace roots on second and upper nodes.	
	Erect.	Leaning and fallen.	Erect.	Leaning and fallen.
FIRST PLANTING.				
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Scutellum rot	22.70	23.21	42.52	58.92
Disease-free	38.19	41.00	37.11	76.36
Diplodia	33.69	50.00	57.14	70.68
Disease-free	31.21	28.35	28.80	47.76
Fusarium	31.70	30.13	29.25	29.31
Disease-free	41.34	36.50	26.66	30.79
SECOND PLANTING.				
Scutellum rot	39.02	50.50	49.02	60.46
Disease-free	36.30	30.70	50.36	80.18
Diplodia	60.76	54.44	55.69	88.88
Disease-free	35.13	52.85	54.95	89.46
Fusarium	38.28	31.57	58.02	71.40
Disease-free	32.39	30.61	59.93	76.53
THIRD PLANTING.				
Scutellum rot	38.55	35.82	54.41	66.66
Disease-free	25.20	23.89	55.29	80.95
Diplodia	58.25	71.42	68.93	64.28
Disease-free	48.41	42.85	69.84	92.85
Fusarium	44.51	45.71	56.09	85.71
Disease-free	50.94	50.00	59.11	95.45
FOURTH PLANTING.				
Scutellum rot	69.56	83.33	60.00	54.16
Disease-free	41.33	47.36	70.00	68.42
Diplodia	60.00	57.14	73.33	90.47
Disease-free	51.29	33.33	63.63	66.66
Fusarium	45.90	32.00	43.44	54.00
Disease-free	40.86	27.47	52.17	64.70

e. Stand and leaning and fallen stalks.—At the same time as the plants in all the plots and plantings were being examined for suckers and brace roots, notes were taken on the number of plants in each plot at maturity and the number of leaning and fallen stalks. Stalks that were decidedly bent by strong wind and stalks that were decidedly leaning were counted as leaning stalks. Plants, the stalks of which touched the ground, were counted as fallen plants. The percentage of stand and the percentage of leaning and fallen stalks were determined. The percentage of stand was obtained by dividing the number of plants on each plot at the time of observation by the total number of kernels planted. The percentage of leaning and fallen plants was obtained similarly. These percentages are given in Table 11. In this table will be noted the reduction of the percentage of stand as the seeding was delayed, and the greater number of leaning and fallen stalks in the first and the second plantings. The last planting had considerably fewer leaning and fallen stalks. The third planting had more than the last, and fewer than did either the first or the second planting. The first and the second plantings were hit by three storms, and the third and the last by one. There is no consistent difference in the number of leaning and fallen stalks among diseased and disease-free plants. There are other factors which cause stalks to lean and to fall besides root destruction by root-rot organisms. Among these causes can be mentioned shallow planting, looseness of the soil, and strong wind. The place of impact of the wind may further cause great differences in the number of leaning and fallen stalks in different parts of a field. A few days before and after tasseling, the stalks are easily bent by strong wind. It was observed that before and after this period the plants were not easily bent.

Table 11 shows that there was no perfect stand in any of the diseased and disease-free plots. The stand of the plants on the *Diplodia* plots was particularly low. A general reduction in the percentage of stand on all the plots took place as the seeding was delayed. This reduction was especially marked on the *Diplodia* plots. Reduction in stand is certainly an important factor in decreasing the yield of corn.

Examination of the figures in Table 11 shows that there is no significant difference in the percentage of leaning and fallen stalks on the diseased and on the disease-free plots. The leaning and falling of stalks is caused by so many factors that they cannot very well be taken as a condition showing root destruction by root-rot organisms.

f. Smut infection of diseased and disease-free corn.—The numbers of plants attacked by smut (killed and not killed) in the

TABLE 11.—*Percentage of stand and of leaning and fallen stalks*

Condition of seed.	East plots.		West plots.	
	Stand.	Leaning and fallen stalks.	Stand.	Leaning and fallen stalks.
FIRST PLANTING.				
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Scutellum rot	84.12	29.24	76.59	29.53
Disease-free	93.65	31.35	78.97	27.63
Diplodia	58.73	38.51	70.23	27.91
Disease-free	91.26	36.95	95.27	27.91
Fusarium	93.17	48.93	94.04	30.80
Disease-free	96.82	28.50	95.23	26.03
SECOND PLANTING.				
Scutellum rot	88.09	35.58	87.69	41.17
Disease-free	96.38	49.38	95.63	46.05
Diplodia	40.87	14.56	49.20	36.21
Disease-free	85.50	35.32	88.49	50.22
Fusarium	93.65	51.69	90.87	49.82
Disease-free	94.44	54.24	95.19	40.80
THIRD PLANTING.				
Scutellum rot	80.95	34.31	81.34	19.02
Disease-free	88.88	32.38	84.12	19.81
Diplodia	41.26	18.26	46.50	11.96
Disease-free	82.53	25.96	80.95	6.85
Fusarium	81.35	16.59	82.93	16.74
Disease-free	76.98	20.10	71.82	11.60
FOURTH PLANTING.				
Scutellum rot	51.19	0.77	50.12	16.10
Disease-free	68.25	4.65	67.06	11.24
Diplodia	31.74	7.50	32.14	25.92
Disease-free	64.28	6.17	69.40	12.00
Fusarium	70.63	6.37	68.25	29.06
Disease-free	76.19	12.50	59.12	22.81

east and the west plots were counted. There was a wide variation in the degree of smut infection. Most of the infection took place on developing ears and tassels. Infection took place also at the upper part of the nodes above and below the ear. In general, infection was localized; it occurred only in certain patches and spread from plant to plant. Dense vegetation and presence of moisture appeared to favor infection. As will be noted from Table 12, smut infection increased from the first to the third planting. There was less smut infection in the fourth planting. This was very probably due to a drier atmosphere. More infection occurred in the west plots, the plots fertilized with manure and rock phosphate only. The results of this observation suggest an interesting problem; namely, that of the relationship of smut infection to nutrition of the corn plant.

TABLE 12.—*Number and percentage of diseased and disease-free corn plants infected with smut.*

Condition of seed.	East plots.			West plots.		
	Plants observed.	Plants killed.	Plants attacked.	Plants observed.	Plants killed.	Plants attacked.
	Number.	*Number.*	*Per cent.*	*Number.*	*Number.*	*Per cent.*
FIRST PLANTING.						
Scutellum rot	212	3	5.18	193	3	5.18
Disease-free	236	2	7.62	199	0	4.54
Diplodia	148	2	12.16	177	0	3.93
Disease-free	230	2	5.65	240	2	6.58
Fusarium	235	2	6.80	237	3	7.17
Disease-free	240	0	4.50	242	0	7.85
SECOND PLANTING.						
Scutellum rot	222	1	13.51	221	2	24.43
Disease-free	243	3	14.40	241	0	16.59
Diplodia	103	0	8.25	124	1	12.50
Disease-free	218	0	8.25	223	2	14.30
Fusarium	236	4	7.20	229	0	24.45
Disease-free	238	2	8.82	240	5	18.75
THIRD PLANTING.						
Scutellum rot	204	3	21.56	205	3	20.97
Disease-free	224	6	13.92	212	1	23.58
Diplodia	104	1	10.57	117	3	24.78
Disease-free	208	2	12.98	204	4	21.56
Fusarium	205	6	10.73	209	9	34.92
Disease-free	194	3	17.01	181	9	31.49
FOURTH PLANTING.						
Scutellum rot	129	0	6.20	149	1	18.79
Disease-free	172	0	10.46	169	1	21.30
Diplodia	80	0	8.75	81	0	8.72
Disease-free	162	0	10.49	175	3	22.85
Fusarium	178	1	7.30	172	2	20.34
Disease-free	192	0	6.25	149	3	19.26

DISCUSSION OF RESULTS

THE DEGREE OF INFECTION; ITS RELATION TO THE LIFE OF THE PLANT

Not all of the kernels on a *Diplodia* ear are infected. The infection on an ear varies. In a few cases, the infection is so severe that all the kernels are killed. In laboratory experiment *e*, kernels 1 to 13 in one row, and kernels 1 to 14 in another row, of seeds from an ear infected with *Diplodia* failed to germinate. The kernels at the butt end germinated, and the seedlings developed as normally as did the seedlings from disease-free kernels. In laboratory experiment *f*, in which were used kernels from an ear badly infected with *Diplodia*, it was found that practically all the kernels were infected; only a few kernels at the butt appeared free of infection. Identical results were obtained in laboratory experiment *g*. In germination tests of hundreds of ears, made by the department of agronomy, in which I had an opportunity of handling the ears to be tested and of observing the final results of the tests, it was found that most of the *Diplodia*-infected kernels were at the tip end of the ears. Infection of an ear may come through a wound on the shank or on the stalks; but the results of the observation show that a large part of the infection takes place through the tip of the ear. Ears the husks of which are tightly closed at the tip are less subject to infection by *Diplodia*.

The infection of the kernel also varies in degree as does the infection of the ear. *Diplodia* composite kernels give a very low percentage of germination. This was found true both in the laboratory experiments and in the field plantings. In laboratory experiment *b* (second part) and in laboratory experiment *d*, for example, the *Diplodia* composite kernels failed to germinate. In laboratory experiments *a*, *b*, and *i*, the percentage of germination of the diseased kernels was especially low. In the field plantings, the percentage of stand of plants on the *Diplodia* plots in the east and in the west sections was much lower than that of the other diseased corn and of the disease-free corn (Table 11). Seedlings from *Diplodia*-infected kernels succumbed at various stages of growth. Some plantlets died at a very early stage after germination; others grew for a few days, attaining a height of a few millimeters, and then died. Observation of germinating kernels and developing seedlings in the seed germinator shows that *Diplodia* killed corn much faster than did *Fusarium*. The severity of the attack of *Di-*

plodia appears to depend on the degree of initial infection in the kernels, other conditions being equal. In the struggle between the plant and *Diplodia* the parasite, in general, overcomes the corn.

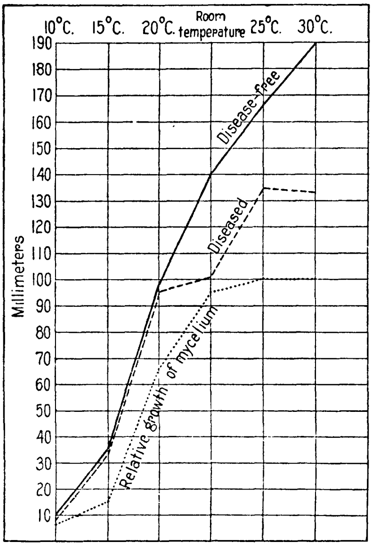

FIG. 1. Effect of temperature on growth of corn and *Diplodia*.

Seedlings from *Diplodia*-infected kernels are very variable in height. In laboratory experiments *a* and *b*, and in other experiments not reported here, especially those in which rag dolls were used as germinating media, it was invariably found upon opening the rag dolls at the end of the experiment that the seedlings from the disease-free kernels were more uniform in height than were the seedlings from the diseased kernels. In the field plantings, the height of the plants, especially those from the *Diplodia* composite kernels, also showed greater variability. There was not much difference in the total heights reached by the plants on the diseased and on the disease-free plots. It will, however, be noted that the mean and the standard deviation of the heights of the plants on the diseased plots, particularly those on the *Diplodia* plots, show much higher probable errors. The coëfficient of variability of the heights of the plants on the diseased plots was consequently higher than that on the disease-free plots, in general. In the laboratory experiments, the degree of initial infection in the seed is very probably the cause of the greater variability in height of the seedlings. In the field plantings, the general results show that it may also be the cause of the greater variability in the heights of the plants on the diseased plots.

Seedlings from *Diplodia* composite kernels die at a very early stage. The seedlings that are able to pass through this early stage develop normally, in general. In the field experiments, in all four plantings there was no change in the stand of the plants on the *Diplodia* plots after the twentieth day from the planting time. Only one or two plants on each *Diplodia* plot were noted, when the ears were developing, that were apparently infected with root rot; the other plants on these plots at maturity looked to be as normal as were those on the disease-free plots.

TEMPERATURE RELATIONSHIPS TO CROP AND DISEASE

That high temperature accelerates and low temperature inhibits germination and growth is very well known. In Plate 1 are shown the germination and growth of diseased and disease-free corn in different uniform temperatures for a period of one week. On the left side of each rag doll are the diseased kernels, and on the right side the disease-free; both kinds of corn are similarly subject to the effect of temperature. In laboratory experiment *a* the average growth of the disease-free seedlings for one week was raised from 9.8 millimeters at 10° C. to 189.5 millimeters at 30° C., and that of the diseased seedlings from 8.2 millimeters to 133 millimeters (fig. 1). In Table 3 the growth of the disease-free seedlings in sand containing 20, 40, and 60 per cent moisture is shown to have increased from 42 to 227 millimeters, from 72 to 228 millimeters, and from 100 to 294 millimeters, at 15 and 30° C., respectively. The effect of fluctuating temperatures on growth was shown in laboratory experiment *b*. In the first part of this experiment greater growth was shown in the uniform temperatures than in the fluctuating temperatures of the same mean (fig. 2). In the field plantings (fig. 3) it will be noted that, at the beginning of the curves for the growth increments of each planting, the seedlings in the later plantings showed a much higher average height in the first twenty days (the *Diplodia* plants having had a much slower start and then gradually overtaking the disease-free) and the curves of the growth increments of the diseased and of the disease-free plants generally

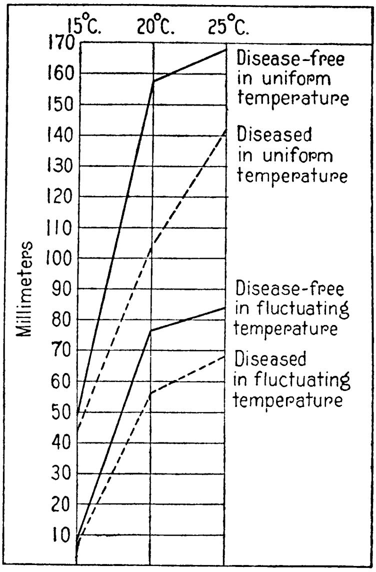

FIG. 2. Effect of fluctuating temperature on growth of diseased and disease-free corn.

zigzagged together, subject to the fluctuation of the weather elements. The growth increments of the plants on the *Fusarium* and on the scutellum-rot plots behaved similarly.

In figs. 6, 10, and 11, showing the relationship of the mean, the maximum, and the minimum temperatures to growth increments, the movements of the temperature and growth increments seem to indicate that the maximum temperature has a greater controlling influence on growth than has the minimum temperature. Figures 6 to 9 show that the greatest growth increments of the tassels occurred in the later plantings—more than 8 inches for the first planting, more than 10 inches for the second, more than 11 inches for the third, and about 11 inches for the last planting, showing greater rate of growth as the planting was delayed.

The severity of the attack of *Diplodia* increased with the rise in temperature. In laboratory experiment *a*, the percentages of kernels and seedlings that rotted were 20, 20, 75, 100, 100, and 100 and the relative spread of the mycelium was 7.5, 15, 65, 95, 100, and 100 (fig. 1) at 10, 15, 20°, room temperature, 25, and 30° C., respectively. In experiment *f*, the percentage of kernels and seedlings that rotted also increased with rise in temperature. Similar results were obtained in experiment *b* (first part); in the second part of this experiment, the development of the mass of the *Diplodia* mycelium increased with rise in temperature. Experiment *d* showed identical results with the maximum development of the *Diplodia* mycelium at 25° C. in sand containing 40 per cent moisture. In the field plantings, the severity of the attack of *Diplodia* is very clearly shown in the stand of the plants on the *Diplodia* plots. The percentage of stand decreased from 58.73 in the first planting to 31.74 in the last planting in the east plots, and from 70.23 in the early planting to 32.14 in the late planting in the west plots. The yields in the east and in the west plots decreased in about the same proportion as did the stand. It appears from the figures in Tables 6, 7, and 11 that the decrease in yield is due more to the decrease in stand as planting was delayed than to the reduction in size of the individual ears due to lateness of planting, at least so far as the four plantings in this experiment are concerned. *Diplodia* attacks corn at all the temperatures (10 to 30° C. in the laboratory experiments) used in these experiments. At 10° C., whereas the corn kernels at the end of one week had hardly germinated, the de-

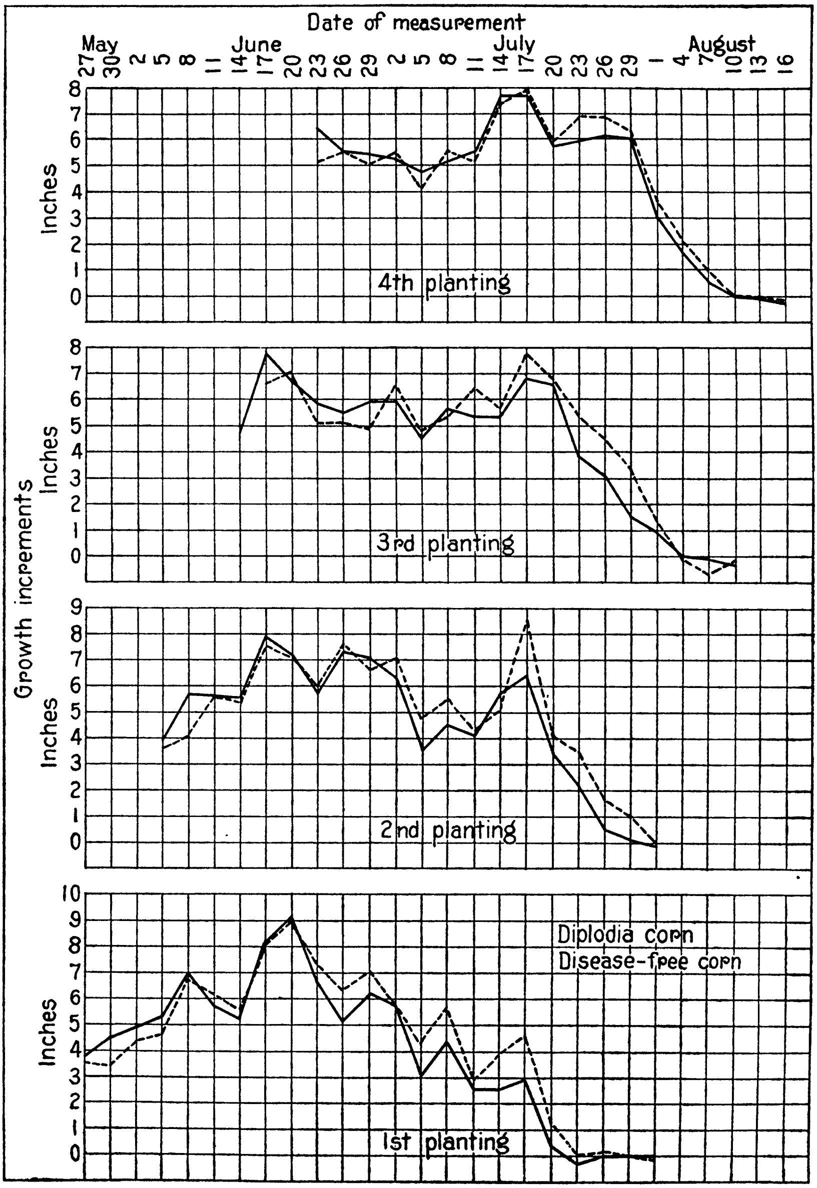

Fig. 3. **Effect of the date of seeding on the growth of diseased (*Diplodia*) and disease-free corn.**

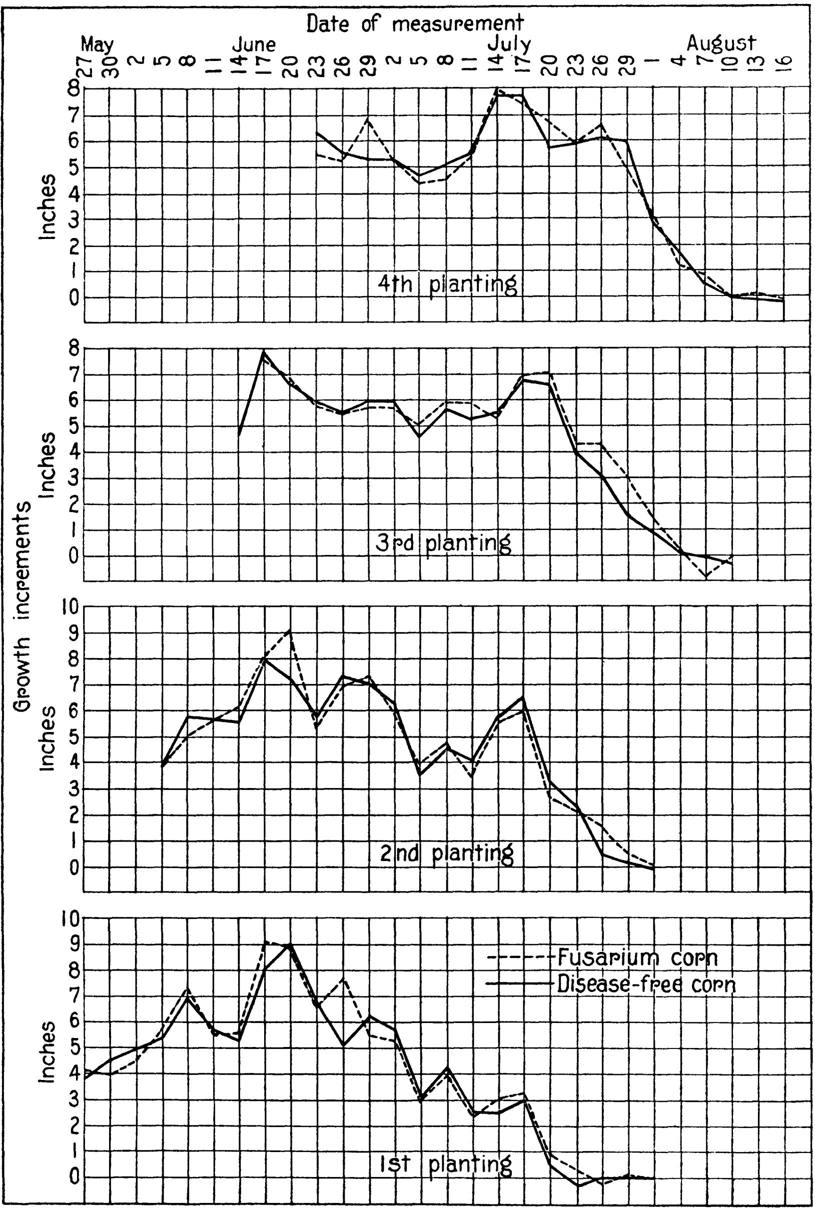

FIG. 4. Effect of the date of seeding on the growth of diseased (*Fusarium*) and disease-free corn.

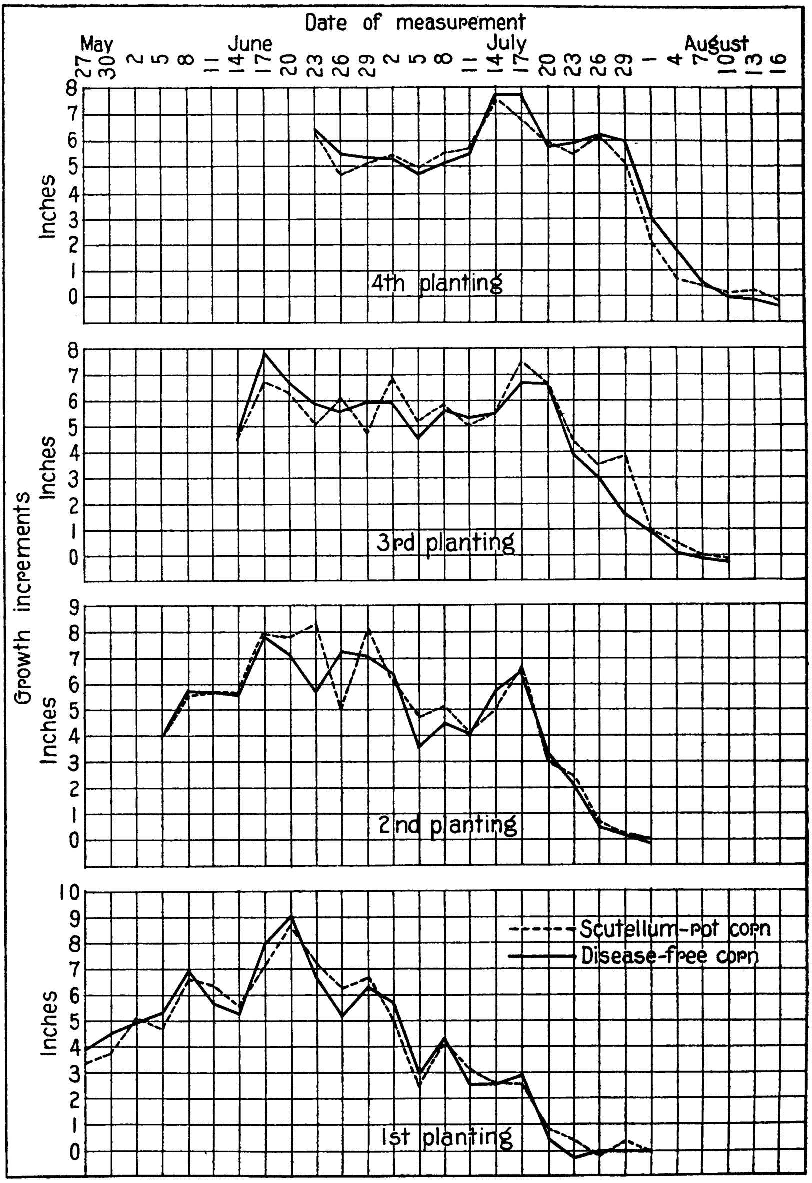

FIG. 5. Effect of the date of seeding on the growth of diseased (scutellum-rot) and disease-free corn.

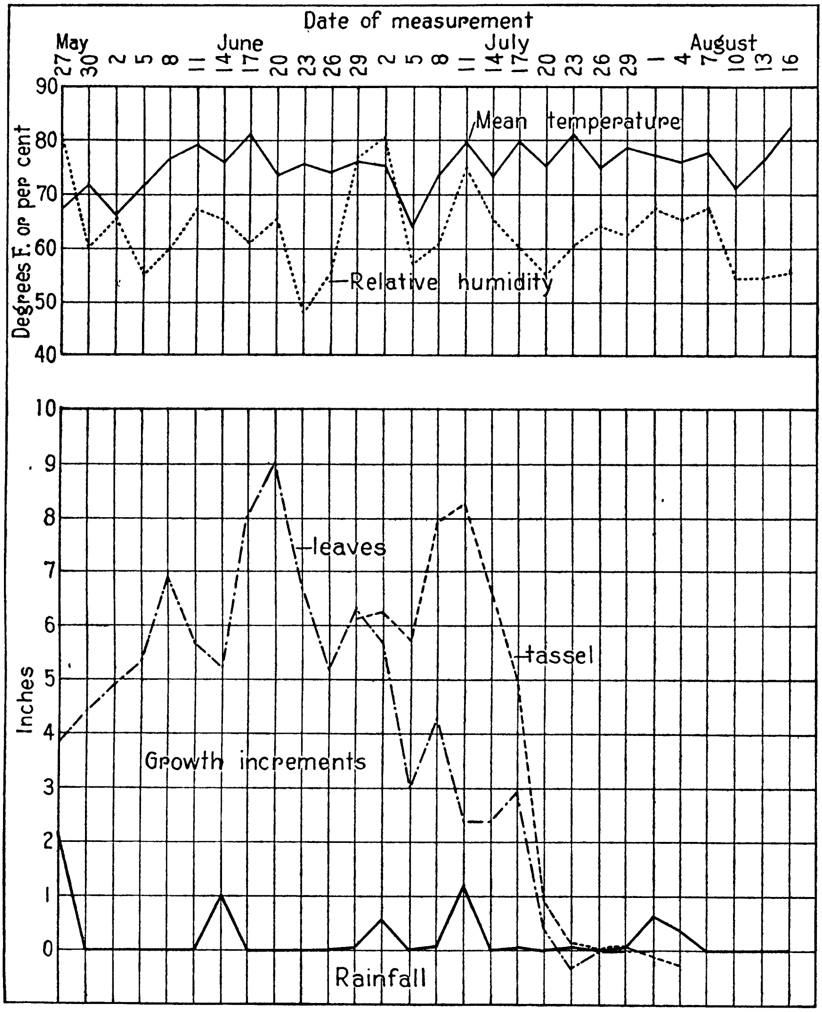

FIG. 6. Effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (First planting.)

velopment of the *Diplodia* mycelium was clearly evident. At the end of four weeks the average height reached by the seedlings that were infected was only about 12 millimeters, but the *Diplodia* mycelium had developed to the extent that whole seeds were thickly covered. Burril and Barret(9) state that the development of *Diplodia* is not confined to the summer months. They found mycelium in a growing active condition on ears partially covered with snow and ice. Parallel results were ob-

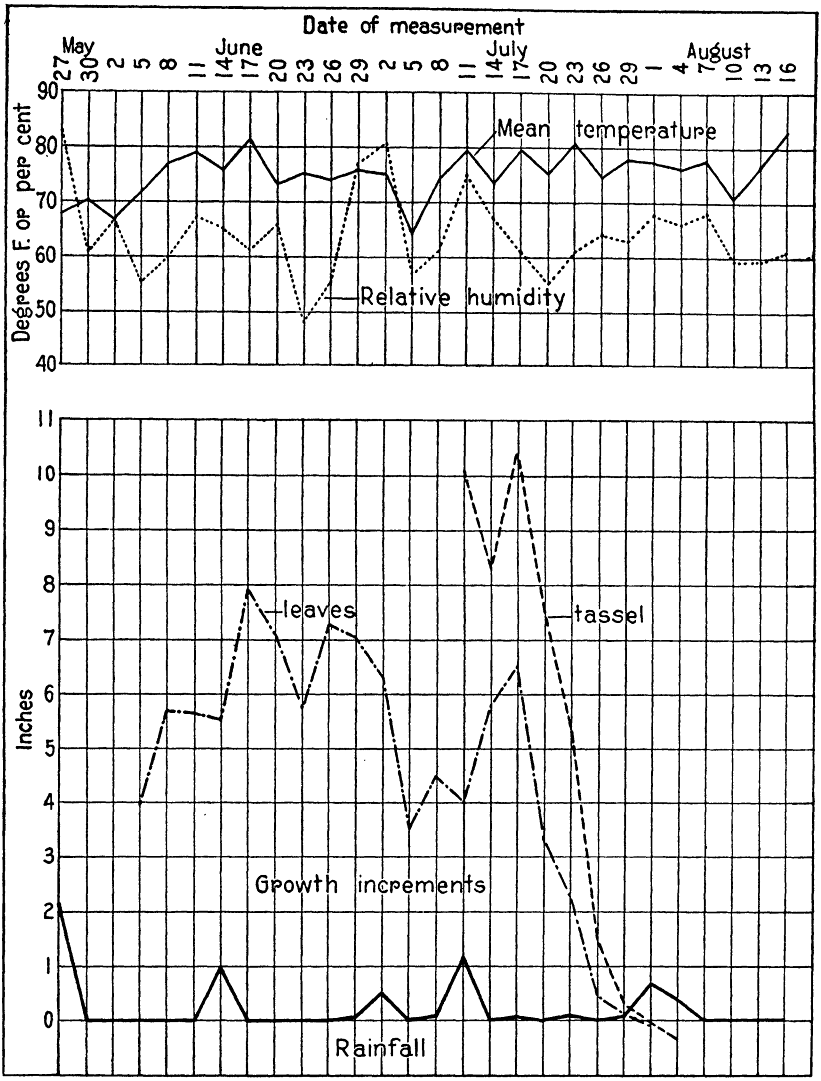

FIG. 7. Effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (Second planting.)

tained in the other temperatures. The cardinal temperatures for the development of *Diplodia* mycelium are apparently the same as the cardinal temperatures for the development of corn, the severity of infection depending largely on the degree of initial infection in the seed. It appears from observation that *Diplodia* develops under a wider range of temperature than does corn.

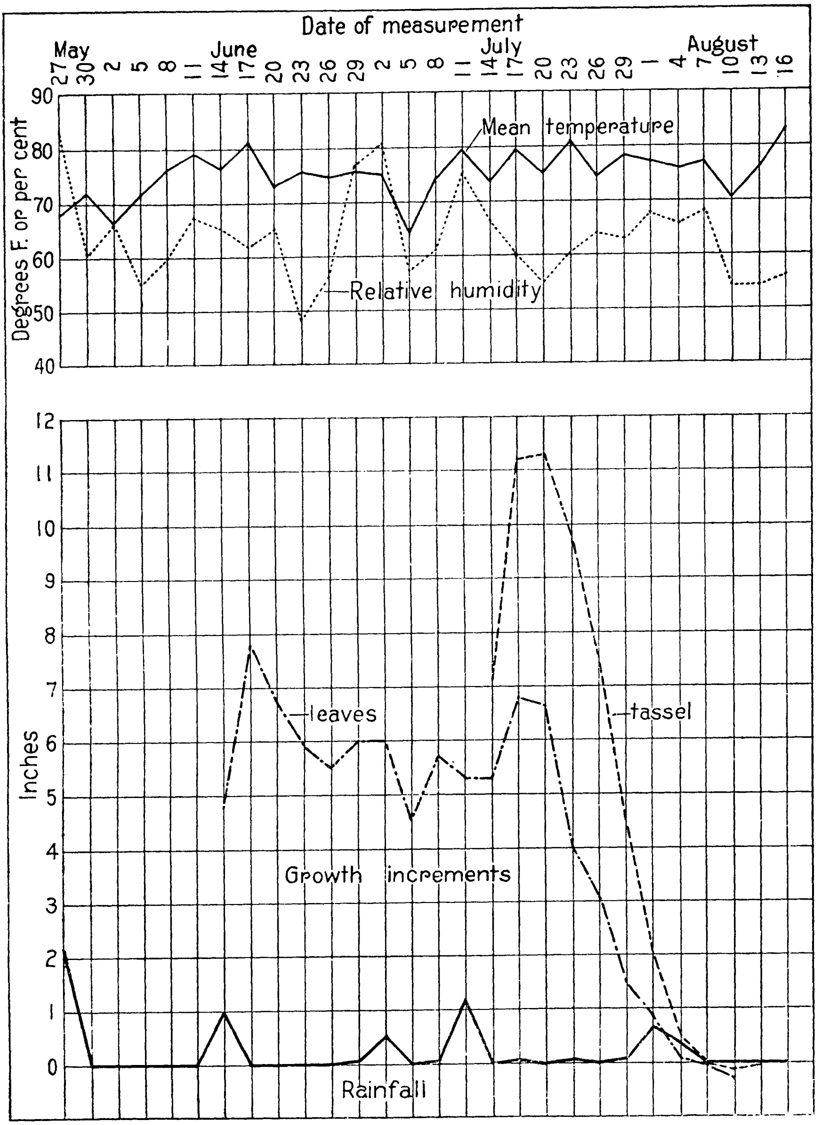

FIG. 8. Effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (Third planting.)

When *Diplodia* infection has started the death of the plant is hastened by other causes, among which are bacteria.

A perusal of the results obtained from the laboratory experiments and from the field plantings shows that the susceptibility of corn to *Diplodia* is increased with rise in temperature. The

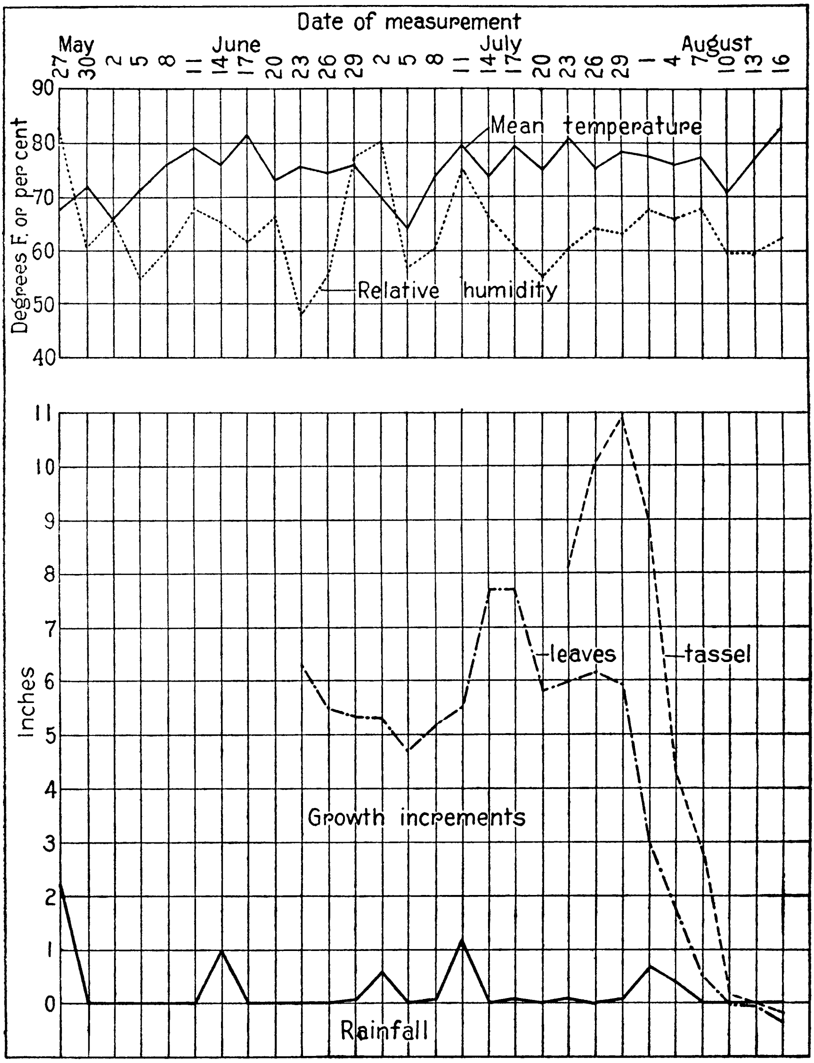

FIG. 9. Effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (Fourth planting.)

susceptibility of corn to smut also increases with rise in temperature. It will be noted from Table 12 that the number of plants attacked by smut and the severity of the attack, as judged by the number of plants killed, increased as planting was delayed. Reduction in the number of plants infected with smut occurred in the latest planting, the fourth; the plants in this planting were subjected to a considerably drier atmosphere than

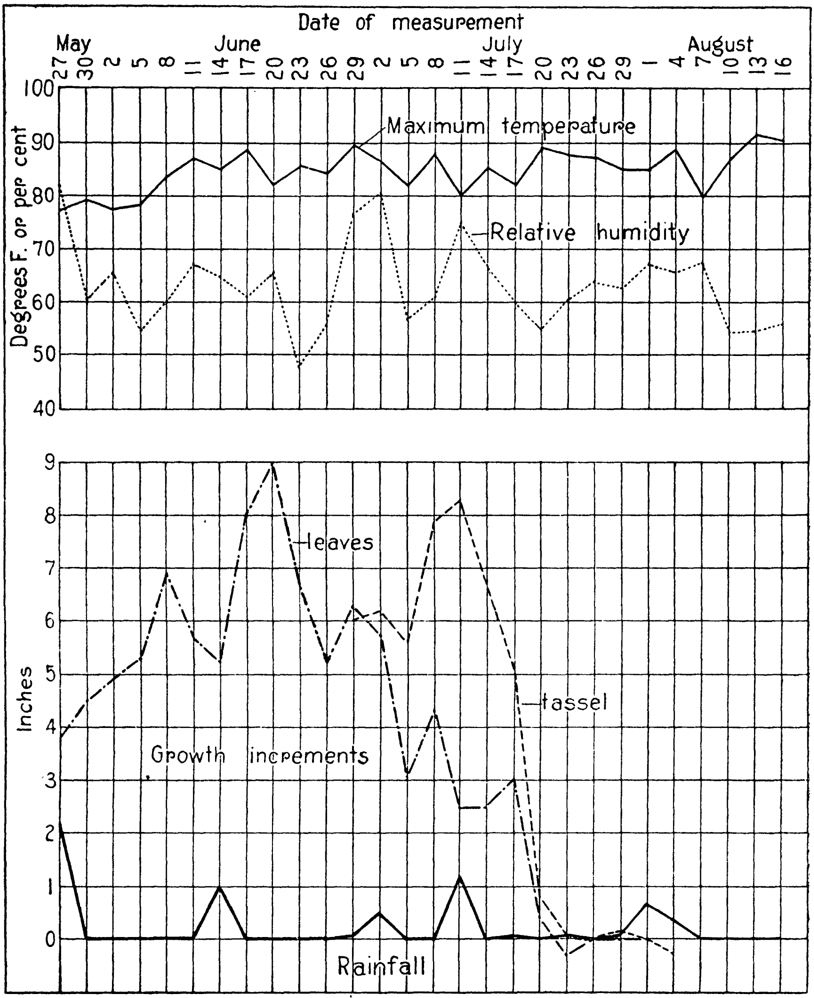

Fig. 10. Effect of maximum temperature, relative humidity, and rainfall on the growth of disease-free corn.

were those in the former plantings. The stand of the plants in this planting was also thinner, thus probably limiting the spread of smut from plant to plant. The work of Brooks and Cooley(7) on the bitter rot in apples, that of Gilman(10) on the relation of temperature to cabbage yellows, that of Jones and Tisdale(15) on the influence of temperature on the development of flax wilt, and that of other investigators(25, 28, 35) on the relation of temperature or climate to infection, have shown that the host plants are more susceptible to parasites at higher

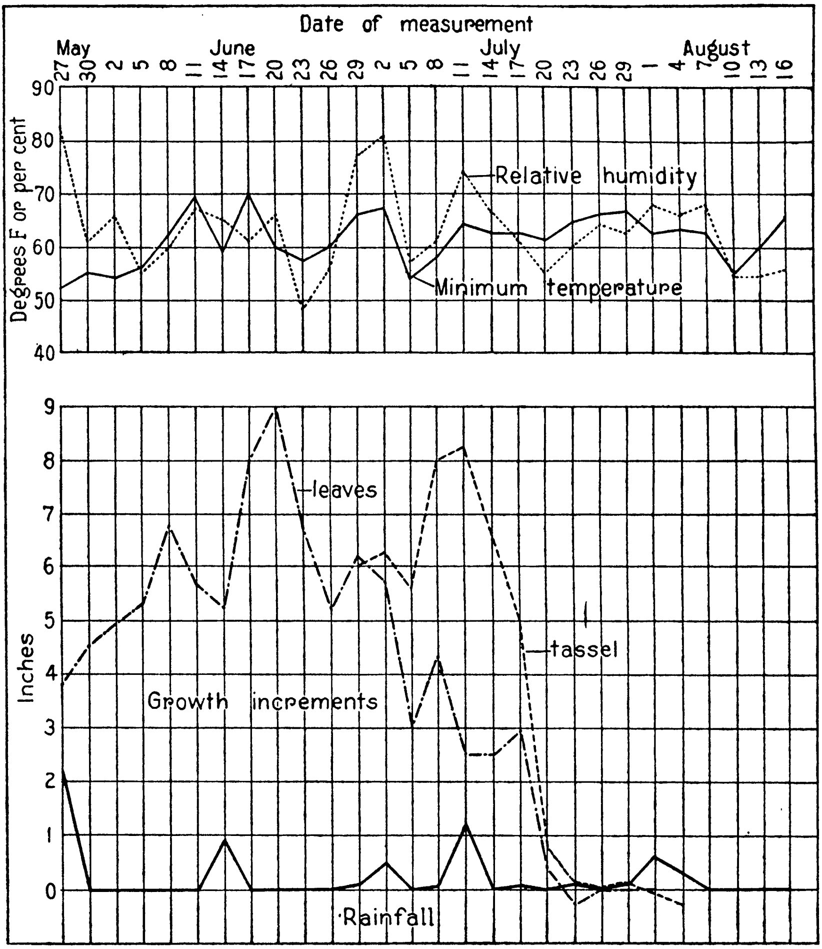

FIG. 11. Effect of minimum temperature, relative humidity, and rainfall on the growth of disease-free corn.

temperatures. Jones and others(16) have found, further, that even relatively resistant cabbage becomes susceptible when grown at high temperatures. It appears that parasites are most pathogenic at the temperature of their most active development. However, in the consideration of the relationship of temperature to disease resistance and susceptibility, not only the presence of the organism must be known, to begin with, but also the stage in the life cycle of the organism and the mass of the organism present.

MOISTURE RELATIONSHIP TO CROP AND DISEASE

The rôle that moisture plays in growth is as indispensable as the rôle played by temperature. The former is more important than the latter at one time, and the latter more important than the former at another time. In Tables 1, 3, and 5, the effect of moisture on growth is very clearly shown. Table 5 shows that at 30° C. the total heights reached by the seedlings in sand containing 20, 40, and 60 per cent moisture for one week were 250, 282, and 320 millimeters, respectively; Table 3 shows that at 10° C. the growth of the seedlings for one month was 32, 49, and 58 millimeters in sand containing 20, 40, and 60 per cent moisture, respectively. From Table 5, the rôle of moisture in increasing the growth of disease-free seedlings is also very evident. In experiment *c,* retardation in the rapidity of germination took place in the pan containing the highest moisture content. It was found in other experiments that, in cultures containing a high percentage of water, the germination of the kernels, especially at the lower temperatures, was retarded. In experiment *g,* in which kernels from different rows of an ear infected with *Diplodia* were used, it was found that the percentage of germination in wet soil was much lower than that in moist soil. Within certain limits, the growth of the *Diplodia* mycelium was increased by an increase in moisture in the media. The increase in development of the *Diplodia* mycelium, caused by an increase in moisture, was also found in experiment *d,* except in the sand containing 60 per cent moisture, in which case the lack of development of *Diplodia* was probably due to the degree of initial infection in the seed, or to organisms repressing the growth of *Diplodia.* In figs. 3 to 5 it will be noted that the growth increments of the three kinds of diseased plants (*Diplodia, Fusarium,* and scutellum rot) and the growth increments of the disease-free plants are affected by fluctuation of the weather elements in the same way. Because of the supposed infection in the roots, the plants on the diseased plots were expected to cease growth earlier, and to show low growth increments after rainless days. They were also expected to show more drying up of the lower leaves. These expectations were not realized. The growth increments of the plants on the diseased and on the disease-free plots followed each other so closely (growth stopping at about the same time) that these indices of root destruction were of no value. In figs. 6 to 11 it will be noted upon examination of the various curves that the effect of moisture and temperature on growth under field conditions is not easy to determine. However, it is easily seen from these curves that the effect of rainfall is not immediate, while that of temperature of the air and relative humidity is immediate. The effect of rain is not expressed in growth, at least not until after the third day. In fig. 6 it will be noted that the growth response of the disease-free plants to the rains on May 27, June 14, and July 2 and 11 was not evident until some days later. In the early planting (fig. 6) it appears that the late growth response is due to the lowering of the temperature of the air, caused by the rain; but in the last planting (fig. 9) the late growth response cannot be due to the lowering of the temperature due to the rain, as the relative positions of the growth-increment point and the temperature point on July 11 show. The relation between the growth of the plant and the weather elements is a complex one. The curve of growth in fig. 6 can be considered as an example. Starting on May 27, the three-day sum of growth to May 30 was positively associated with the temperature, and negatively associated with the relative humidity; to June 2, the growth was negatively correlated with the temperature, and positively correlated with the relative humidity; to June 5, the growth was again positively associated with the temperature, and negatively associated with the relative humidity; and to June 8, the growth was positively correlated with both the temperature and the relative humidity. On June 11, however, the growth due to shortage of soil moisture on account of lack of rain for several days could not follow either the relative humidity of the air or the temperature. Following the courses of the curves in figs. 7 to 9 it will be noticed that, as long as the moisture of the soil is sufficient, the relative humidity has a powerful influence on growth. On the other hand, when the soil moisture is insufficient, the relative humidity does not affect growth. In his experiment on the effect of relative humidity and temperature on the growth of bean seedlings, Patterson(26) found in the laboratory, under controlled conditions, the same relationship between soil moisture, relative humidity, and growth. In the second, third, and fourth plantings, the curves in the corresponding figures for these plantings show the same relationship between weather elements, soil moisture, and growth. At one time growth goes with the temperature of the air; at another time with the relative humidity; and at still another time with the soil moisture. The work of Shibata,(32) Lock,(22) and Smith(33) is very well known, and the reconciliation of the results obtained by these investigators proposed by Blackman(5) in his theory of limiting factors appears to hold in substance, as far as the results of these experiments are concerned. The principle also appears to hold true in the relationship of temperature and moisture to the development of plant diseases.

The particular stage in the life cycle of the corn plant must also be taken into consideration in the study of the relationship of temperature and moisture to growth increments. The growth increment, as will be noted in figs. 6 to 9, rises progressively until it reaches its maximum, and then decreases gradually. It seems that, if the plant were subjected to absolutely uniform conditions, the curve of the growth increments would ascend and descend gradually, showing that the amount of growth-increment response to the same condition varies according to the particular stage in the life cycle of the plant. In fig. 6, for example, on June 5, after nine rainless days, when the relative humidity and the temperature of the air were not higher than on previous days, the growth increments are shown to have risen gradually because of other factors. It is clear that the correlation table cannot reliably interpret the relation of temperature or moisture to growth of corn.

SUMMARY

Infection of corn by *Diplodia zeae* (Schw.) Lev. is generally effected through the tip of the ear.

The degree of infection of the ear and of the kernel varies.

The length of life of the seedling or of the plant depends upon the degree of initial infection in the kernel.

The severity of the attack on corn by *Diplodia* increases with rise in temperature.

Corn is more susceptible to *Diplodia* and to smut at higher temperatures.

The cardinal temperatures for the development of *Diplodia* parallel the cardinal temperatures for the development of corn.

Diplodia has a wider range of temperature for its development than has corn.

The decrease in yield as seeding was delayed, as far as the experiments reported here are concerned, is due more to the reduction in stand than to the reduction in size of the ear due to lateness of planting.

Plants on the diseased plots were more variable in height than were plants on the disease-free plots.

The death of corn caused by *Diplodia* generally takes place in the plantlet stage.

Plants that escape the *Diplodia* attack in the early stage develop just as normally as do disease-free plants.

Leaning and fallen plants, production of suckers, and production of brace roots are not conclusive evidences of root destruction caused by root-rot organisms.

The relationship of temperature and moisture to the growth of diseased and disease-free corn follows the law of limiting factors.

ACKNOWLEDGMENTS

This work has been carried on under the joint advice of Dr. William L. Burlison, professor of crop production, and Dr. Charles F. Hottes, professor of plant physiology, both of the University of Illinois. To them I am indebted for guidance and encouragement. I am also indebted to Dr. James R. Holbert, of the United States Department of Agriculture, for furnishing me with the seeds used in the laboratory experiments, and to Mr. George H. Dungan and his colleagues, in the division of crop production, for much valuable help in and information on the field experiments.

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ILLUSTRATIONS

Plate 1. Effect of temperature on the germination and growth of corn.

TEXT FIGURES

Fig. 1. Chart showing effect of temperature on growth of corn and *Diplodia.*
2. Chart showing effect of fluctuating temperature on growth of diseased and disease-free corn.
3. Chart showing effect of the date of seeding on the growth of diseased (*Diplodia*) and disease-free corn.
4. Chart showing effect of the date of seeding on the growth of diseased (*Fusarium*) and disease-free corn.
5. Chart showing effect of the date of seeding on the growth of diseased (scutellum-rot) and disease-free corn.
6. Chart showing effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (First planting.)
7. Chart showing effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (Second planting.)
8. Chart showing effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (Third planting.)
9. Chart showing effect of mean temperature, relative humidity, and rainfall on the growth of disease-free corn. (Fourth planting.)
10. Chart showing effect of maximum temperature, relative humidity, and rainfall on the growth of disease-free corn.
11. Chart showing effect of minimum temperature, relative humidity, and rainfall on the growth of disease-free corn.

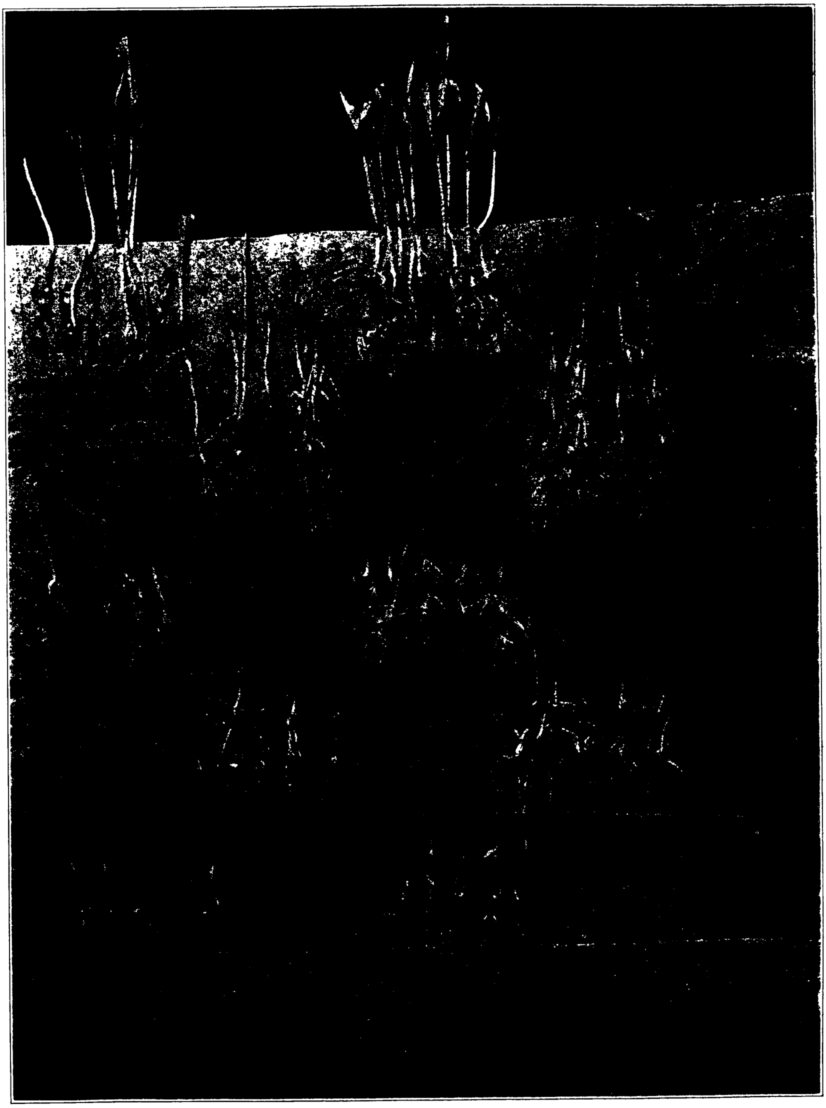

PLATE 1. EFFECT OF TEMPERATURE ON THE GERMINATION AND GROWTH OF CORN.

FOUR RARE PHILIPPINE FISHES

By Albert W. Herre

Chief, Division of Fisheries, Bureau of Science, Manila

ONE PLATE AND ONE TEXT FIGURE

GEMPYLIDÆ

THE ESCOLARS

A group of mackerel-like fishes with elongate and more or less compressed body, covered with minute to very minute scales; the large head is laterally compressed, with projecting lower jaw and large mouth, the teeth very strong, some of the front teeth caninelike; the opercles are unarmed in adults, with radiating spines in the young; the dorsal fin is long, with a notch separating the weak spines from the rays; the anal and soft dorsal each with a prominent lobe anteriorly, and often with finlets posteriorly; the caudal peduncle is slender, usually not keeled, the caudal fin forked; the ventrals are small, often reduced to a single spine; the gill openings are wide, the membranes not united, free from the isthmus, gills four, a slit behind the fourth; vertebræ numerous, 32 to 53; pyloric cæca not numerous; an air bladder usually present.

Widely distributed fishes of the open sea, some of them descending to or living at considerable depths, most of them used for food.

But one genus is definitely known from the Philippines.

Genus **PROMETHICHTHYS** Gill

Promethichthys Gill, Mem. Nat. Ac. Sci. **6** (1893) **115**, **123**.

Body elongate, slender, spindle-shaped, laterally compressed; the spinous dorsal long, the soft dorsal and anal high anteriorly, each with two finlets posteriorly; the ventrals reduced to a pair of minute spines; no dagger-shaped spine behind vent; the mouth large with large canines anteriorly; the smooth scales very minute, the skin apparently naked; the lateral line undulating anteriorly, then it descends obliquely below the midline of the body and continues on back to the caudal fin.

Greedy fishes of the open sea, or bottom dwellers in moderately deep seas.

Promethichthys prometheus (Cuvier and Valenciennes).

Gempylus prometheus CUVIER and VALENCIENNES, Hist. Nat. Poiss. 8 (1831) 156, pl. 222.

Gempylus solandri CUVIER and VALENCIENNES, Hist. Nat. Poiss. 8 (1831) 158.

Prometheus atlanticus LOWE, Proc. Zool. Soc. London 7 (1839) 78.

Thyrsites prometheus GÜNTHER, Cat. Fishes 2 (1860) 351.

Promethichthys prometheus GILL, Mem. Nat. Ac. Sci. 6 (1893) 115; GOODE and BEAN, Oceanic Ichthyology (1895) 200, with text figure; JORDAN and EVERMANN, Fishes of Hawaii, Part 1 (1905) 178, pl. 29.

Name at Cabalian, Leyte, *langpoi.*

Dorsal XVIII–1–18–II; anal II–17–II; V. I.

The low, elongate, slender body much compressed laterally, its extreme breadth 2.6 times in the depth, the extreme width of the head 1.73 times in the body depth and 3.6 times in the length of the head; the depth 6.4 times, the large, laterally flattened head a little more than 3 times in the length; snout long, sharp-pointed, 2.7 times in the head; the large circular eye high up, 4.15 times in the head, more than 1.5 times in the snout; the interorbital has an elongate concave groove, its breadth 1.44 times in the eye; mouth large, the lower jaw strongly projecting, the posterior angle of the maxillary beneath the front margin of the pupil; each jaw has a single row of strong, sharp, backward-inclined teeth, the first pair in the lower jaw longer and caniniform; at the front of the upper jaw in my specimen are three very large sharp fangs, one at the symphysis and a pair behind it, over half an eye diameter in length, very strong, fixed, and preventing the mouth from being closed; a row of small sharp backward-inclined teeth on each palatine; I find no teeth on vomer or tongue, as stated by Jordan and Evermann; the caudal is rather small, the upper lobe largest, a trifle less than 5 times in the length; the middle spines of the dorsal are longest, 1.3 times in the depth; the anterior dorsal and anal rays are highest, three-fourths the longest dorsal spine; the ventral is reduced to a single wide blunt spine; the whole body is covered with closely fitting smooth scales, largest posteriorly, those on the cheeks very minute; the lateral line runs nearly horizontally to under the fourth dorsal spine, then descends sharply, obliquely backward to the middle of the body, then describes a long, gradually downward curve, rising again on the lower half of the caudal peduncle, and continuing on the caudal fin; the pectorals are placed low down.

The color is purplish brown, with a silver sheen over all, the head blackish, the fin membranes all black.

Here described from a specimen 167 millimeters in length, caught with hook and line at a depth of about 50 meters, in the sea off Cabalian, Leyte. It is well known to the fishermen there. First known from St. Helena, in the south Atlantic Ocean, it has since been taken at Madeira, the Bermudas, Australia, Hawaii, and Japan. It is common at Madeira, where the fishermen capture it on the bottom at a depth of 100 to 400 fathoms.

MALACANTHIDÆ

The body is elongate, spindle-shaped, more or less laterally compressed; the labroid head somewhat conical, with thick lips and elongate snout, its profile more or less convex; no bony stay for the suborbital; the cranial bones not cavernous; the terminal mouth low, nearly horizontal; the teeth sharp, rather small, none on the vomer, palatines, or tongue; the premaxillary usually has a small blunt posterior canine, somewhat as in the Labridæ; the premaxillaries are protractile; maxillary not slipping under the edge of the preorbital, without a supplemental bone; lower pharyngeals separate; scales very small, ctenoid; lateral line complete, usually following the dorsal outline; the dorsal fin long, low, continuous, the spinous portion much shorter than the other part, but never wanting; the anal fin long, low, with one or two feeble spines or none; ventrals thoracic or subjugular, close together, with one spine and five rays; the caudal fin forked, the tail diphycercal; pectoral fins moderate, with only branched rays; gill opening wide, with four gills, a long slit behind the fourth; gill membranes separate or more or less united, often adherent to the isthmus; pseudobranchiæ well developed; branchiostegals five or six; air bladder simple; pyloric appendages few or none.

Fishes of the open sea or about oceanic islands, intertropical in range; some of them reach a large size and all are valued for food.

Genus **MALACANTHUS** Cuvier

Malacanthus CUVIER, Régne Animal, ed. 2, 2 (1829) 264.

Oceanops JORDAN and SEALE, Fishes of Samoa, Bull. Bur. Fisheries 25 (1906) 277.

The elongate body laterally compressed, the mouth horizontal or nearly so, jaws equal, the lips thick; dorsal very long, continuous, with four to six soft spines and 45 to 60 rays; anal with one or two soft spines or none, and 40 to 55 rays; the operculum has a spine, the preoperculum is entire; the outer teeth are small with minute teeth behind, some of the teeth more or less enlarged.

The subgenus *Oceanops* Jordan and Seale, distinguished by its more-elongate snout and brilliant coloration, does not seem to me to be worthy of generic rank on such grounds.

Key to the Philippine species of Malacanthus.

1. Head and snout long, labroid; a broad black lateral band; dorsal 4–43 to 46; subgenus *Oceanops*.. **M. latovittatus.**
2. Head and snout shorter, convex; two black longitudinal converging bands on caudal fin; dorsal 5–53 to 57.. **M. parvipinnis.**

Malacanthus latovittatus (Lacépède).

Labrus latovittatus LACÉPÈDE, Hist. Nat. Poiss. 3 (1798) 527, pl. 28, fig. 2; QUOY and GAIMARD, Voy. Astrolabe 3 (1835) 701, pl. 20, fig. 3.

Malacanthus taeniatus CUVIER and VALENCIENNES, Hist. Nat. Poiss. 13 (1839) 239, pl. 381.

Malacanthus latovittatus GÜNTHER, Cat. Fishes 3 (1861) 360.

Oceanops latovittatus JORDAN and SEALE, Bull. Bur. Fisheries 25 (1906) 277.

Local name, *nalagalep*.

Dorsal IV, 43 to 46; anal I, 40; there are 130 scales in the lateral line in my specimen, 125 according to authors.

The elongate body subcylindrical from the head to the end of the short trunk, the tail laterally compressed and longer than the head and trunk together, the head elongate with produced snout, the anterior profile slightly convex from the first dorsal to the eyes, then straight to the tip of the snout; the depth 5.33 times, the head 3.63 times in the length; the head and trunk together contained 1.28 times in the tail; the mouth large, low down, nearly horizontal, the lips thick, the posterior angle of the maxillary falling much short of a perpendicular from the eye, its length 76.6 per cent of the snout; the teeth in the upper jaw in a broad band anteriorly, which is much narrowed posteriorly; the outer row is of enlarged teeth, terminating at the rear in a small canine, the other teeth minute; the teeth of the outer row in the lower jaw enlarged, sharp-pointed, those on the sides largest; behind this is a band of minute teeth, broad in front and disappearing posteriorly; the posterior margin of the opercle terminates in a strong sharp spine; the body everywhere covered with small, finely ctenoid scales, which extend upon the nape and sides of the head beyond the eyes, those before the first dorsal minute; the dorsal low, the spines and rays all flexible, the rays a little forward of its middle longest, 3 times in the head; the anal equals the dorsal in height, the longest rays in its anterior portion; the caudal subtruncate, or the margin may be undulate-lunate, 1.83 times in the head, 6.66 times in the length; the pectoral equals the caudal, its central rays longest, ending in a long point; the ventrals narrow, very close together, 2.64 times in the head.

The color is brilliant violet blue above, with a broad deep black band from above and behind the pectoral to the caudal where it divides, part continuing to the caudal tip, and a broad band descending to the lower part of the fin, thence to the posterior extremity, leaving a white and golden square on the posterior part of the lower half of the caudal; the upper part of the caudal blue; the underside of the head and the belly pale whitish violet; the rest of the body below the lateral band and the anal yellowish white; the pectoral blackish basally, the rest of the fin greenish golden; the head blue with a curved black band behind and below the eye.

In alcohol the blue changes to blackish.

Here described from a specimen 240 millimeters long, caught with hook and line at Santo Domingo de Basco, Batan Island, Batanes Province, where it is well known to the fishermen.

This very beautiful fish was first described from Mauritius, in the Indian Ocean, and soon after from New Guinea, and for a long time was not known elsewhere. Its recorded range now includes Samoa, the Pelew Islands, and a number of East Indian localities recorded by Bleeker. The colors are subject to a considerable degree of minor variation, but the intense blue above, the long black lateral band, and the paler underparts are always present.

Malacanthus hoedtii Bleeker.

Malacanthus hoedtii BLEEKER, Act. Soc. Sc. Indo-Neerl. **6** (1859) 18; GÜNTHER, Cat. Fishes **3** (1861) 361; Fische der Südsee **2** (1876) 160, pl. 98, fig. B.

Malacanthus parvipinnis VAILLANT and SAUVAGE, Rev. Maj. Zool. **3** 3 (1875) 283; JORDAN and EVERMANN, Bull. U. S. Fish. Comm. **23**[1] (1903) (1905) 276, fig. 118.

Local name, *teuay*.

Dorsal V, 53 to 57; anal I, 50 to 51 in my specimens ("A. 50", Günther; "A. 53", Jordan and Evermann); 168 to 173 scales in the lateral line to the end of the caudal vertebræ, with four or five more tubules extending on the caudal.

The head and body laterally compressed, spindle-shaped, the dorsal and ventral profiles tapering strongly back to the caudal peduncle, the depth 6.4 to 6.8 in the length; the anterior profile of the head strongly convex, 4.7 to 4.94 times in the length; the posterior margin of the opercle ends in a strong spine, not included in the length of the head given above; the long convex pointed snout 3 times in the head; the eye very high up, lateral, 3.9 times in the head; the broad, flat interorbital 2.83 to 3 times in the head; the mouth very low down, oblique to almost horizontal, the upper lip thick, the posterior angle of the maxillary beneath the front margin of the large pupil; the nostrils in front of the middle of the eye, the anterior one circular with a tubulate lip, the posterior one a horizontal slit; the outer teeth in the upper jaw enlarged, especially at the front, terminating near the angle of the mouth in a small, forward-pointed canine; about five rows of minute teeth in a band behind the outer row anteriorly, decreasing in number and disappearing at the middle of the jaw; in the lower jaw a short band of six or seven rows of teeth is behind the symphysis, all the teeth minute except those of the outer row; the outer teeth increase in size posteriorly, largest at the middle of each side, where there are three or four stout conical teeth; behind these the row is continued by much smaller teeth; the scales very small but distinct, extending forward to the eyes and well out on the caudal fin, those before the first dorsal minute, indistinct; the scales of the lateral line minute; the dorsal and anal very long, sharply angulate posteriorly, highest before the central part of their length, the most anterior portion very low, all the spines and rays flexible, the longest rays of the two fins equal in height, 2.6 to 2.7 in the head if measured along their length, 4.25 times in the head if the vertical height is measured; the caudal truncate, 7.6 to 8 times in the length, 1.6 times in the head; the depth of the caudal peduncle about 3.8 times in the head; the pointed pectoral 7 to 7.4 times in the length, 1.45 to 1.5 times in the head; the narrow pointed ventrals very close together, 10.66 to 11.1 times in the length, 2.2 to 2.26 times in the head.

The color of a fresh specimen was smoky gray above, with about twenty vertical curved or angulate bars of the same color on the sides and descending nearly to the bottom, the lower parts fading into white; on the cheeks and opercles were a number of small lemon yellow spots, and the tip of the lower jaw was also lemon yellow; the dorsal was red, the anal lemon yellow; the caudal bright lemon yellow, with two longitudinal jet black bars, beginning on the caudal peduncle at the upper and lower origins of the caudal and converging but not meeting posteriorly; the pectoral was slightly smoky gray; the ventrals were white.

In alcohol the dorsal has lost its red hue, and the yellow has faded, except on the caudal; the colors are otherwise unchanged.

Here described from two specimens, 160 and 178 millimeters in length. They were caught with hook and line at Santo Domingo de Basco, Batan Island, Batanes Province, where this fish is common.

This Quaker-clad fish is found from Mauritius to Hawaii and the Society Islands.

XIPHASIIDÆ

This family of eel-like naked blennies has the tail greatly elongated, laterally compressed, the eyes very large, lateral, the dorsal and anal very long and united to the caudal; the ventral fins are of three rays, elongated and filamentous, inserted on the throat at the branchial arch, before the gill opening; the maxillary and mandibulary teeth are of uniform or nearly uniform size, close together; far back in the lower jaw is a pair of enormous curved canines; still farther back in the upper jaw is a pair of much smaller though still large canines; the palate is toothless, the suborbital bone is rough.

A group of strange-looking and rare fishes, with one genus and two or three distinct species—one of unknown habitat, the others hitherto only known from the Indian Ocean.

The function of the extraordinary canines, particularly the preposterous ones of the lower jaw, is not clear. It is difficult to believe that the fish could open its mouth sufficiently to use them in defending itself. They are so long and so curved that the points are out of sight even when the mouth is opened to its fullest extent. Of course it is possible that in life the jaws might open more widely. According to Jerdon, quoted by Day, it is "said to be venomous."

Genus XIPHASIA Swainson

Xiphasia SWAINSON, Nat. Hist. 2 (1839) 259.
Nemophis KAUP, Proc. Zool. Soc. London (1858) part 26, 168.
Xiphogadus GÜNTHER, Cat. Fishes 4 (1862) 374.

The tail is 4 to 5 or more times as long as the head and trunk together, much compressed laterally, especially posteriorly, the trunk and head more rounded but also laterally compressed, the whole body very low; the fin rays all flexible, the dorsal beginning on the head, before, behind, or above the eyes; the gill openings small, restricted, before the base of the pectoral fin; the dorsal and anal high; branchiostegals six. The other characters are as given for the family.

Xiphasia setifer Swainson.

Ophidium tonkah-talawaree RUSSELL, Descriptions and Figures of Fishes of Coromandel 1 (1803) 28, pl. 39.
Xiphasia setifer SWAINSON, Nat. Hist. 2 (1839) 259; DAY, Fishes of India (1878) 337, pl. 73, fig. 1.
Xiphogadus setifer GÜNTHER, Cat. Fishes 4 (1862) 374.

Dorsal 126; anal 112.

The form is very elongate, slender, eel-like, laterally compressed, especially on the tail, the depth just back of the head 33.5 times in the length; the tail very attenuate, becoming ribbonlike posteriorly, and is 85 per cent of the length; the head is boldly convex anteriorly, nearly as long as the trunk, wider than the body, 14.37 times in the length, its depth a fourth greater than its breadth and two and a third times in its length; the trunk subcylindrical, a little less than 13 times in the length; the head and trunk together are 5.8 times in the length; the eye is rather large, circular, lateral, high up, 4.375 times in the head, 1.375 times in the snout, which is strongly convex, downward projecting, 3.18 times in the head; the mouth slants up and back, the lower jaw the shorter, with slender, somewhat irregular, flattened, incisorlike teeth closely appressed in a compact projecting row in each jaw; posteriorly to the row of teeth in the lower jaw is a pair of relatively enormous, very strong, sharp, backward-curved canines, their length three-fourths of an eye diameter; these canines fit into large cavities running upward and backward before the eyes; behind these cavities is a pair of much smaller, downward-projecting canines, only their tips showing when the mouth is fully stretched open.

The dorsal begins before the eye and gradually increases in height, reaching its maximum before the posterior end of the first third of the body, then gradually decreasing to the tail, the longest ray about 1.85 times in the head, the greatest vertical height of the fin 2.9 times in the head; the anal is similar, its greatest height about the middle of its length 3.88 times in the head, the longest ray 3.18 in the head; the caudal has its two central rays greatly elongated, hairlike, 10 times in the length; the pectoral is rather broad, short, 1.94 times in the head; the ventrals are very narrow, elongate, 1.84 times in the head.

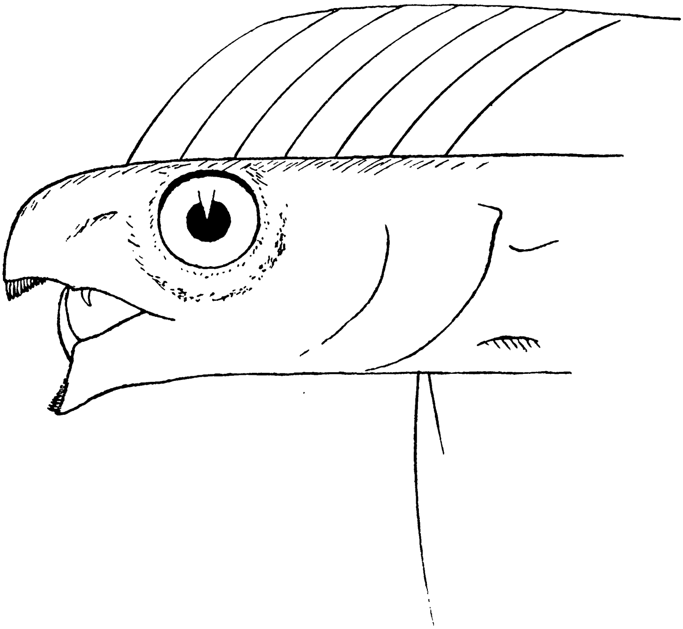

FIG. 1. *Xiphasia setifer* Swainson; head, × 2.

The color when fresh was bright yellow, with twenty-eight broad dusky brown crossbands on the dorsal and body, the first just behind the head; the dorsal yellow at its origin, both dorsal and anal with a broad marginal blackish band; the caudal filament black; the head dusky yellowish; the ventrals yellow; the pectorals yellow with flesh red longitudinal lines.

In alcohol the yellow has faded to pale brownish yellow and the dorsal is largely black, the pectoral dusky; the fading has caused the fish to appear as though crossed by eleven wide pale bands, each between a pair of blackish brown bars.

Here described from a specimen 503 millimeters long, collected at Dumaguete, Oriental Negros, by Dr. J. W. Chapman, professor of biology at Silliman Institute.

ILLUSTRATIONS

PLATE 1. *Xiphasia setifer* Swainson, × ¾.

TEXT FIGURE

FIG. 1. *Xiphasia setifer* Swainson; head, × 2.

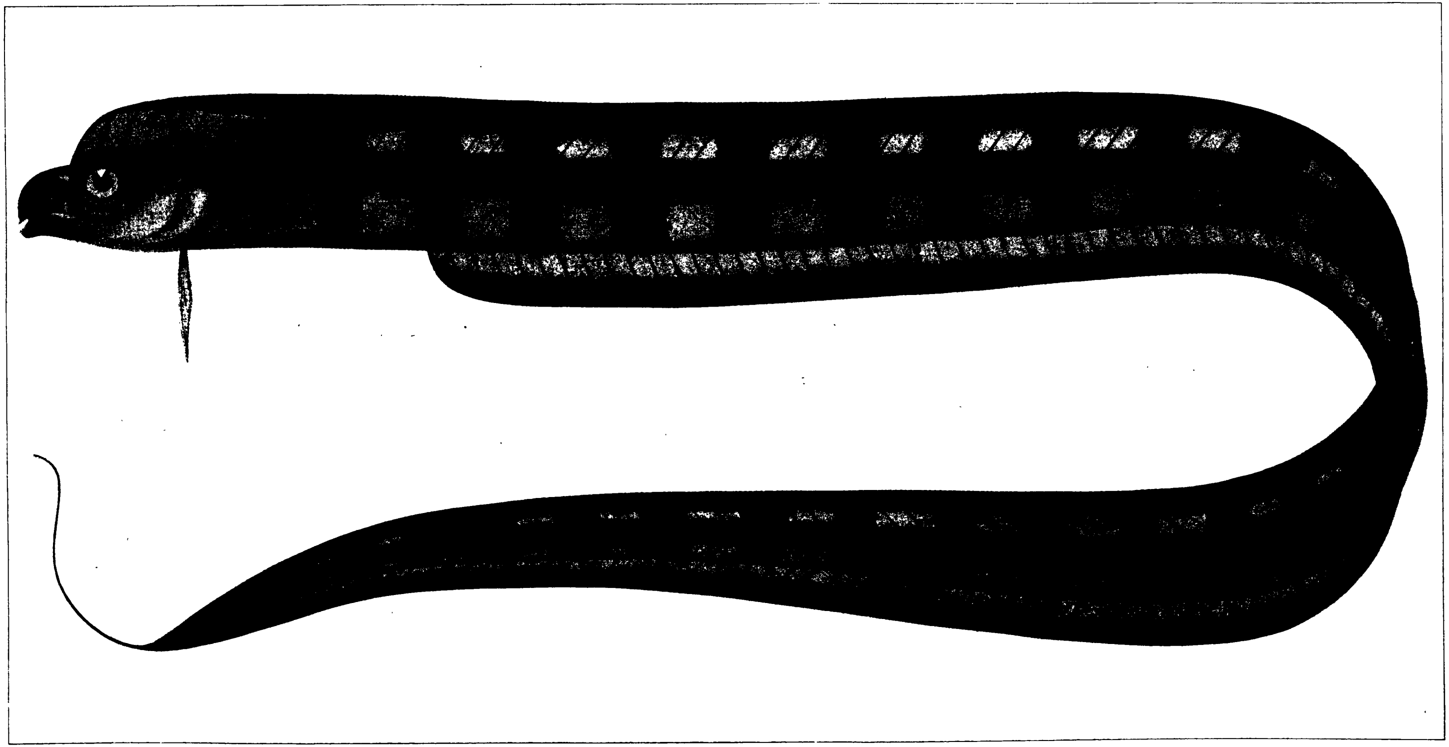

PLATE 1. XIPHASIA SETIFER SWAINSON, x ¾

NEW FLAGELLATA FROM NORTH MANCHURIA, CHINA[1]

By B. W. Skvortzow

Of Harbin, Manchuria

ONE PLATE

In a series of notes on Flagellata of Manchuria I have already described more than one hundred fifty new species and varieties of *Trachelomonas* Ehrenberg. Many of the new forms of these inferior organisms were of scientific interest due to their peculiar construction and geographic distribution.

The investigation of water basins, continued by me in the summer of 1924, has convinced me of the original character of the Flagellata observed.

In the present note I give a description of twenty-seven forms of this genus kindly gathered for me by Mr. I. W. Kozlov in August, 1924, in rice fields of the Mutatiang River in the eastern part of the country, near Eho station of the Chinese Eastern Railway. Sixteen of these are new and are here described.

Trachelomonas volvocina Ehrenberg.

Shell brown, 10 to 15 μ in breadth. Common.

Trachelomonas kelloggi Skvortzow var. **punctata** Skvortzow. Plate 1, fig. 11.

Shell brown, dotted, 40.8 μ in length, 30.8 μ in breadth. Flagella hole, 5 μ in breadth. Chromatophores numerous.

Trachelomonas kelloggi Skvortzow var. **coronata** var. nov. Plate 1, fig. 1.

Shell brown, oval, broad-elliptical, dotted. Flagella hole covered with spines. Shell, 25.5 μ in length; 20.4 μ in breadth. Flagella hole, 2.5 μ in breadth. Chromatophores numerous.

Trachelomonas depressa Swirenko var. **punctata** Skvortzow. Plate 1, fig. 2.

Shell brown, dotted, 18.7 μ in length, 21 to 22 μ in breadth. Flagella hole, 2.5 μ in breadth. Chromatophores numerous.

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[1] From the Sungari River Biologic Station of the Manchuria Research Society, at Harbin.

Trachelomonas pulchra Swirenko **var. punctulosa** var. nov. Plate 1, fig. 3.

Shell brown, dotted, 24 μ in length, 22 μ in breadth. Flagella hole, 2 μ in breadth. Chromatophores numerous.

Trachelomonas wislouchi Skvortzow. Plate 1, figs. 4 and 5.

Shell brown, 25.5 μ in length, 28.9 to 30.6 μ in breadth. Flagella hole, 5 μ in breadth. The enlarged neck, 23.8 to 25.5 μ in breadth. Spines obtuse, 2 to 2.5 μ in length. Five or six obtuse spines are placed around the flagella hole, but at some distance from the hole.

Trachelomonas wislouchi var. glabra var. nov. Plate 1, fig. 6.

Flagella hole without obtuse spines, but with an angular brim. Shell spines small, in other respects similar to the typical form.

Trachelomonas wislouchi Skvortzow **var. collaris** var. nov. Plate 1, fig. 7.

Flagella hole with outside spines thickly placed around the hole, in other respects similar to the typical form.

Trachelomonas plantonica Swirenko **var. kozlovi**[2] var. nov. Plate 1, fig. 8.

Shell brown, dotted, 27.2 μ in length, 22 μ in breadth. Neck turned up, 4.2 μ in length, 3.4 μ in breadth. Chromatophores numerous.

Trachelomonas arnoldiana Skvortzow **var. manchurica** var. nov. Plate 1, fig. 12.

Shell brown, covered with knobs; 27.2 μ in length, 22.5 μ in breadth. Neck straight, 5.9 μ in length, 3.4 μ in breadth. Chromatophores numerous.

Trachelomonas raciborskii Woloszynska **var. punctata** Skvortzow. Plate 1, fig. 25.

Shell brown, 40.8 μ in length, 30.6 μ in breadth. Flagella hole, 3.4 μ in breadth.

Trachelomonas baikovi Skvortzow **var. punctata** var. nov. Plate 1, figs. 13 and 14.

Shell brown, dotted and covered with spines; 47.6 to 52.7 μ in length, 25.5 to 27.2 μ in breadth. End spine, 8 to 8.9 μ in length. Neck, 5 μ in length and breadth. Chromatophores numerous; in other respects similar to the typical form.

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[2] Named in honor of Mr. I. W. Kozlov, botanist, who found this form.

Trachelomonas acanthostoma Stokes. Plate 1, fig. 15.

Shell brown, dotted; 42.5 μ in length, 34 μ in breadth. Flagella hole, 5.1 μ in breadth. Chromatophores numerous.

Trachelomonas teres Maskell var. **glabra** var. nov. Plate 1, fig. 16.

Shell brown, smooth, without a neck; length, 37.7 μ, breadth, 25.5 μ. Flagella hole, 3.4 μ in breadth. Chromatophores numerous; in other respects similar to the typical form.

Trachelomonas orienburgica Swirenko var. **hypacantha** var. nov. Plate 1, fig. 17.

Shell oval, brown, dotted, covered with spines in the upper part; 27.2 μ in length, 17 μ in breadth. Neck, 2.5 μ in breadth. Chromatophores numerous.

Trachelomonas oblonga Lemmermann.

Shell brown, 15.3 μ in length, 10.2 μ in breadth. Flagella hole, 1.7 μ in breadth.

Trachelomonas oblonga var. **punctata** Lemmermann. Plate 1, fig. 19.

Shell brown, dotted; 22.1 μ in length, 13.6 μ in length. Flagella hole, 2.5 μ.

Trachelomonas nobilis Skvortzow var. **paludosa** var. nov. Plate 1, fig. 10.

Shell oval, brown, covered with knobs; 20.4 μ in length, 15.3 μ in breadth. Flagella hole, 1.7 μ in length, 5.1 μ in breadth. Chromatophores numerous.

Trachelomonas armata (Ehrenberg) Stein.

Shell, 35 μ in length, 28 μ in breadth. Rare.

Trachelomonas armata (Ehrenberg) Stein var. **rotunda** var. nov. Plate 1, fig. 9.

Shell broad-oval, brown, dotted; 39.1 μ in length (without spines), 37 μ in breadth. Flagella hole, 4.2 μ in breadth. The upper part with small spines, the lower part with large spines.

Trachelomonas armata (Ehrenberg) Stein var. **brachycentra** var. nov. Plate 1, fig. 18.

Shell broad-oval, brown, dotted, and covered with spines; length, 45 μ; breadth, 37 μ. Flagella hole, 5 μ in breadth. End spine short.

Trachelomonas armata (Ehrenberg) Stein var. **rigens** var. nov. Plate 1, fig. 20.

Shell broad-oval, smooth; 49.9 μ in length, 35.4 μ in breadth. Flagella hole, 4.2 μ in breadth. The upper and the lower part of the shell covered with spines. Chromatophores numerous.

Trachelomonas heterospina Swirenko var. **armata** var. nov. Plate 1, fig. 21.

Trachelomonas helvetica Lemmermann var. *armata* Skvortzow.

Shell brown, covered with spines; 37.4 μ in length, 17 μ in breadth. Flagella hole, 4 μ in breadth, with large spines. Chromatophores numerous.

Trachelomonas hispida (Petry) Stein var. **crenulatocollis** (Maskell) Lemmermann. Plate 1, fig. 22.

Shell brown, 35.7 μ in length, 25.5 μ in breadth. Flagella hole, 3.4 μ in breadth. Chromatophores numerous.

Trachelomonas crebea Kellicott var. **punctata** var. nov. Plate 1, fig. 23.

Shell brown, dotted; 39.1 μ in length, 23.8 μ in breadth. Flagella hole, 5 μ in length and breadth; in other respects similar to the typical form.

Trachelomonas ianczowskii Drezepolskii. Plate 1, fig. 24.

Trachelomonas pulchra Swirenko var. *bispinosa* Skvortzow.

Trachelomonas ianczowskii var. **decorata** var. nov.

Shell brown, dotted, covered with small spines; 37.4 μ in length, 34 μ in breadth. Flagella hole, 4.2 μ in breadth. Chromatophores numerous; in other respects similar to the typical form.

Trachelomonas intermedia Dangeard. Plate 1, fig. 26.

Shell brown, dotted; 18.7 μ in length, 15 μ in breadth. Flagella hole, 2.2 μ in breadth.

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ILLUSTRATIONS

PLATE 1

FIG. 1. *Trachelomonas kelloggi* Skvortzow var. *coronata* var. nov.
2. *Trachelomonas depressa* Swirenko var. *punctata* Skvortzow.
3. *Trachelomonas pulchra* Swirenko var. *punctulosa* var. nov.
FIGS. 4 and 5. *Trachelomonas wislouchi* Skvortzow.
FIG. 6. *Trachelomonas wislouchi* var. *glabra* var. nov.
7. *Trachelomonas wislouchi* Skvortzow var. *collaris* var. nov.
8. *Trachelomonas plantonica* Swirenko var. *kozlovi* var. nov.
9. *Trachelomonas armata* (Ehrenberg) Stein var. *rotunda* var. nov.
10. *Trachelomonas nobilis* Skvortzow var. *paludosa* var. nov.
11. *Trachelomonas kelloggi* Skvortzow var. *punctata* Skvortzow.
12. *Trachelomonas arnoldiana* Skvortzow var. *manchurica* var. nov.
FIGS. 13 and 14. *Trachelomonas baikovi* Skvortzow var. *punctata* var. nov.
FIG. 15. *Trachelomonas acanthostoma* Stokes.
16. *Trachelomonas teres* Maskell var. *glabra* var. nov.
17. *Trachelomonas orienburgica* Swirenko var. *hypacantha* var. nov.
18. *Trachelomonas armata* (Ehrenberg) Stein var. *brachycentra* var. nov.
19. *Trachelomonas oblonga* var. *punctata* Lemmermann.
20. *Trachelomonas armata* (Ehrenberg) Stein var. *rigens* var. nov.
21. *Trachelomonas heterospina* Swirenko var. *armata* var. nov.
22. *Trachelomonas hispida* (Petry) Stein var. *crenulatocollis* (Maskell) Lemmermann.
23. *Trachelomonas crebea* Kellicott var. *punctata* var. nov.
24. *Trachelomonas ianczowskii* Drezepolskii.
25. *Trachelomonas raciborskii* Woloszynska var. *punctata* Skvortzow.
26. *Trachelomonas intermedia* Dangeard.

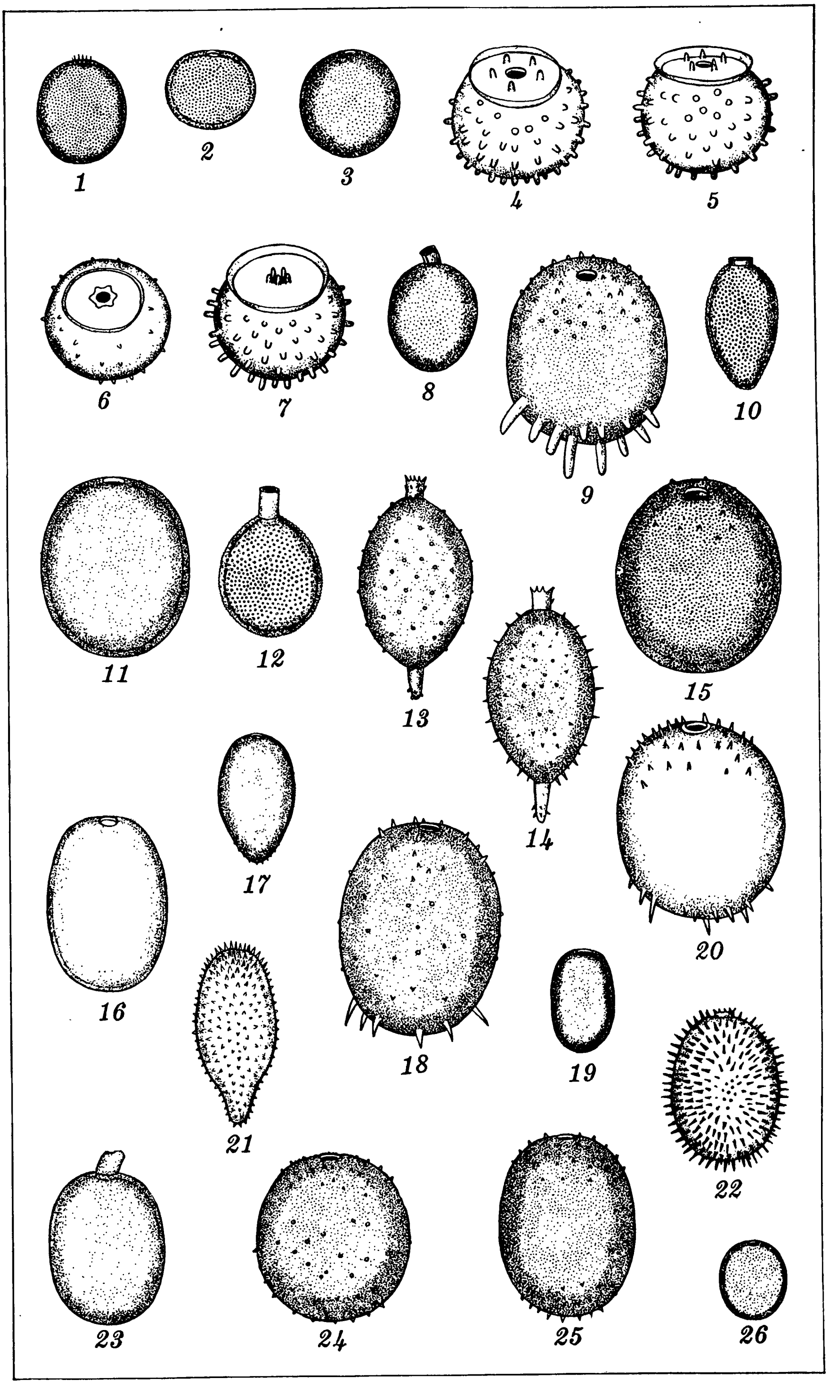

PLATE 1.

FAUNA SAMARENSIS: COLEOPTERA, BUPRESTIDÆ

By W. S. FISHER

Of the Bureau of Entomology, United States Department of Agriculture

In working over the buprestid material from a rather extensive collection of Coleoptera collected by R. C. McGregor on Samar Island, Philippines, during May and June, 1924, several undescribed forms were found. As few species of Buprestidæ have been recorded from Samar, it seems advisable to include a list of those previously described. Nearly all of the species known to occur on this island are represented in the collection of the United States National Museum, some of this material having been previously sent to the museum by Prof. Charles Fuller Baker, University of the Philippines, Los Baños, Philippine Islands.

Castalia obsoleta Chevrolat.

Strigoptera obsoleta CHEVROLAT, Rev. Zool. (1841) 221.

There are several females of this species in the United States National Museum which were collected on Samar by the J. B. Steere Expedition. This species shows a striking sexual dichromatism; the females are much larger, more robust, and with a large orange-red spot on each elytron, while the males are much smaller and slenderer, and the elytra are without spots.

Chrysochroa (Chrysochroa) fulminans Fabricius.

Buprestis fulminans FABRICIUS, Mant. Ins. 1 (1787) 178.

Specimens of this species were collected on Samar by the J. B. Steere Expedition, and among the material received from R. C. McGregor were four specimens collected on the same island during May, 1924. All of the specimens examined from this island are very uniform in coloration, the dorsal surface is green, with a distinct golden tinge when viewed in certain lights, scarcely any blue reflection on the pronotum, and the tips of the elytra are only narrowly margined with a bright reddish cupreous color.

Epidelus wallacei Thomson.

Chalcophora wallacei THOMSON, Arch. Ent. 1 (1857) 109–110.

There is one female of this species in the United States National Museum from Samar, collected by C. F. Baker (*Baker 22544*). This specimen differs slightly from examples from Borneo, the type locality. It is more robust, dorsal surface green, with a slight golden tinge on the pronotum, and without a distinct cupreous tinge, head not fiery red, and the legs darker blue. It is the variety described by Saunders [1] as *philippinensis*.

Iridotaenia cupreomarginata Saunders.

Iridotaenia cupreomarginata SAUNDERS, Trans. Ent. Soc. London (1874) 304–305.

A male of this species was collected by C. F. Baker on Samar (*Baker 22543*) and sent to the United States National Museum.

Chrysodema (Thymedes) flavicornis Saunders.

Chrysodema flavicornis SAUNDERS, Trans. Ent. Soc. London (1874) 306–307.

A single female was collected by R. C. McGregor on Samar, June 5, 1924.

This species is easily distinguished from all other species of the genus in having the marginal carina of pronotum sharply defined and extending to the anterior margin. Waterhouse has made this species the type of his subgenus *Thymedes*.

Chrysodema cavifrons sp. nov.

Female.—Form oblong-oval, attenuate in front and more acuminate behind, and moderately convex; when viewed in profile, the ventral surface is nearly straight to apical third, then strongly attenuate to apex, the dorsal surface feebly arcuately rounded; head violaceous black, with the lateral margins, anterior margin, and punctures golden green; pronotum and elytra with the depressed areas and punctures golden green, and the reliefs violaceous black; beneath golden green, the legs slightly more bluish green, with a feeble violaceous tinge.

Head with a deep, concave depression on the front and vertex, the concavity extending to margin of eyes, and with a longitudinal groove extending the entire length, the groove deeply impressed on the front; surface slightly uneven, with a slight, obtuse elevation behind the antennal cavities, and rather deeply irregularly punctate, the punctures dense and somewhat confluent along the eyes, becoming finer and more inconspicuous in the concave area, and without distinct pubescence; epistoma broadly, arcuately emarginate in front; antennæ black, except first two joints which are bronzy green, and the surface clothed with a few inconspicuous hairs.

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[1] Trans. Ent. Soc. London (1874) 314.

Pronotum moderately convex, slightly more than one-half wider than long, distinctly narrower in front than behind, and widest at basal half; marginal carina slightly sinuate, and not attaining the apical angle; sides nearly parallel from base to apical third, then strongly narrowed to the apical angles, where they are feebly constricted; anterior margin arcuately emarginate, and without a distinct median lobe; base transversely truncate; surface with a feeble elevation on each side near lateral margins, a round, shallow depression on each side near base midway between the median carina and lateral margin, a narrow, smooth, median carina extending from base to anterior margin, deeply, coarsely punctate, the punctures confluent in some places, very irregularly distributed, causing numerous, irregular, smooth reliefs, and without distinct pubescence. Scutellum wider than long, rectangular, and the surface nearly smooth.

Elytra rather strongly convex, without basal depressions, and wider than pronotum at base; sides arcuately rounded from base to near middle where they are broadly, feebly constricted, then arcuately attenuate to the tips which are rather acute, the margins very coarsely serrate at apical half; humeral angles broadly rounded; each elytron with four distinct broad costæ, not including the sutural elevation which is longitudinally divided behind the scutellum; first costa entire, extending from base to apex, and parallel to the sutural margin; second costa sinuate anteriorly, and extending from base to near apex, where it is connected to the first costa; third costa short, extending from behind the humerus to apical fourth, and parallel with the marginal costa; and a marginal costa extending from the humeral angle to apex, and parallel with the lateral margin; there are also indications of a short costa at base between the second and third costæ; all of the costæ are about an equal distance apart, smooth on top, and with a few large punctures irregularly distributed; intercostal spaces with a few irregular, transverse reliefs, especially in basal region, densely punctate, the punctures large, irregularly distributed, and more or less confluent, and the surface without conspicuous pubescence.

Abdomen coarsely punctate, the punctures sparsely placed on the median part of the basal segments, but becoming denser and more or less confluent toward the sides and apex, densely clothed with fine, erect, inconspicuous hairs, and the intervals finely reticulate; first segment broadly, longitudinally concave at middle; last segment broadly rounded at apex and without any emargination; rest of body beneath deeply and irregularly punctate, the punctures coarse and widely separated at the middle but becoming denser and more confluent toward the sides.

Length, 25 millimeters; width, 9.5.

Type locality.—Samar Island, Philippines.

Type.—Catalogue No. 28741, United States National Museum.

Described from a single female collected at the type locality by R. C. McGregor on June 21, 1924.

This species is allied to *eximia* Castelnau and Gory and to *dohrni* Saunders. From the former it differs in having the head violaceous black, basal joints of antennæ green, margins of pronotum and elytron not cupreous, and the underside of body green, without a distinct cupreous tinge. From *dohrni* it can be distinguished by the head and reliefs on dorsal surface being violaceous black, and the underside of body green.

Chrysodema samarensis sp. nov.

Female.—Similar in form to *cavifrons* Fisher; head violaceous black, with the lateral margins, anterior margins, and punctures golden green; pronotum and elytra with the reliefs violaceous black, the punctures golden green, lateral margins of pronotum and lateral margins of elytra posteriorly slightly cupreous, and the entire dorsal surface with a distinct, bright, bronzy tinge when viewed in certain lights; beneath golden green, with a distinct cupreous reflection.

Head with a deep, oblong depression on the front and vertex, the concavity extending to margin of eyes, and with a longitudinal groove extending from the occiput to near the epistoma, the groove wider and more deeply impressed on the front but becoming only feebly impressed on the occiput; surface slightly uneven, with two irregular ridges behind the antennal cavities, and irregularly punctate, the punctures coarse and somewhat confluent along the eyes, and becoming sparsely and very irregularly placed in the concave area, and clothed with very fine, long, erect hairs along the eyes; epistoma broadly, arcuately emarginate in front; antennæ black, except the first two joints, which are cupreous, and each joint armed with a few long hairs.

Pronotum moderately convex, one-half wider than long, distinctly narrower in front than behind, and widest at base; marginal carina feebly sinuate and not attaining the apical angles; sides feebly arcuately narrowed from base to apex, where they are feebly constricted; anterior margin arcuately emarginate, and without a distinct median lobe; base nearly truncate; surface at the sides slightly protruding, but not obscuring the marginal carina, with a broad, shallow depression (slightly interrupted at middle) on each side, from which extends a narrow depression obliquely forward to the apical angle, with a broad, smooth, median carina extending from base to anterior margin, deeply, coarsely punctate, the punctures somewhat confluent, very irregularly distributed, causing numerous, irregular, smooth reliefs, and without conspicuous pubescence. Scutellum wider than long, trapezoidal in form, and the surface nearly smooth.

Elytra rather strongly convex, without basal depressions, and wider than pronotum at base; sides nearly parallel and more or less sinuate to apical third, then strongly, arcuately attenuate to the tips, which are acute, and the lateral margins very coarsely serrate from near middle to apex; humeral angles obtusely rounded or subangulate; each elytron with four rather broad costæ, not including the sutural elevation, the costæ much confused in the basal region, and with longitudinal intercostæ, which are nearly as strongly elevated as the costæ, and connected transversely by irregularly placed reliefs, the intercostal depressions finely, densely, and very irregularly punctate, and the surface without distinct pubescence.

Abdomen densely and finely punctate, except on the median part of the two basal segments, where the punctures are coarse and widely separated, on rest of surface they are irregularly distributed, more or less confluent in some areas, and the surface is densely clothed with fine, moderately long, semierect hairs; first segment broadly, longitudinally concave at middle; last segment rather acute at apex, with a small, angular emargination at the tip.

Male.—Differs from the female in having the antennæ longer and slenderer, last abdominal segment with a large, deep, angular emargination at the tip, middle tibiæ and femora densely clothed with long, cinereous pubescence on the underside, and with an elongate spot of similar pubescence on the inner margin of the posterior coxæ.

Length, 22 to 28 millimeters; width, 8 to 10.

Type locality.—Samar Island, Philippines.

Type, allotype, and paratypes.—Catalogue No. 28742, United States National Museum. Paratypes returned to R. C. McGregor; there are also examples of this species in the collection of C. F. Baker, under his number 22542.

Described from twenty-two examples (twenty-one females and one male). Type (female), allotype, and nineteen paratypes collected at the type locality by R. C. McGregor during June and July, 1924, and one paratype collected by C. F. Baker on the same island (*Baker 22542*).

This species is closely allied to *Chrysodema antennata* Saunders, but can be distinguished from that species by the absence of coppery spots on the elytra, and the reliefs of a violaceous black color; in *antennata* the reliefs are bronzy green, and each elytron is ornamented with two coppery yellow spots, one just behind the humerus and the other behind the middle. It also resembles *Chrysodema granulosa* Kerremans and *Chrysodema hebes* Kerremans, but both of these species are described as having the antennæ glabrous. The species is very uniform in coloration and has a distinct coppery bronze tinge when viewed in certain lights.

Dicercomorpha albosparsa var. **nigroviridis** var. nov.

Differs from the typical *albosparsa* Castelnau and Gory in being of a brilliant dark green color, and not black; round pubescent spots on elytra larger than those shown in the figure of that species; sides of pronotum angulated, and not rounded, and the pubescent spots on underside of abdomen white instead of yellow, as given for *albosparsa*.

Length, 19 to 24 millimeters; width, 7.5 to 9.5.

Type locality.—Samar, Philippines.

Other localities.—Butuan, Mindanao, Philippines.

Type and paratypes.—Catalogue No. 28743, United States National Museum. Paratype returned to R. C. McGregor; there are also examples of this variety in the collection of C. F. Baker under his number 14551.

Described from seven examples. Five (one, type) were collected at the type locality by R. C. McGregor on May 30 and

June 1, 1921; one from Butuan, Mindanao, collected by C. F. Baker (*Baker 14551*); and one old specimen in the United States National Museum, labeled "Philippine Islands, E. A. Mearns." The last-mentioned specimen was probably collected on the Mearns Expedition to Mount Apo, Mindanao.

This beautiful variety is very uniform in markings and coloration, except that the specimens from Mindanao are slightly darker than are those from Samar. The typical form of *albosparsa* was described from Java and, after examining a series of specimens from the Philippines, it seems advisable to give this form a new name.

Chrysobothris pictiventris Saunders.

Chrysobothris pictiventris SAUNDERS, Trans. Ent. Soc. London (1874) 316–317.

One specimen in the United States National Museum collected by R. C. McGregor on Samar, May 30, 1924.

Belionota sagittaria Eschscholtz.

Belionota sagittaria ESCHSCHOLTZ, Zool. Atlas, pt. 1 (1829) 9–10, pl. 4, fig. 5 (reprint pp. 8–9).

This species was described from Manila, and seems to have a wide distribution in the Philippines. In the United States National Museum are specimens of this species received from C. F. Baker from Sibuyan Island, Palawan, Mindanao, and recently the museum has received ten specimens collected on Samar by R. C. McGregor during the latter part of May and the beginning of June, 1924.

Belionota fallaciosa H. Deyrolle.

Belionota fallaciosa H. DEYROLLE, Ann. Soc. Ent. Belg. 8 (1864) 84–85.

This is also a common species and it has been recorded from a number of islands in the Philippines. In the United States National Museum are nine examples collected by R. C. McGregor on Samar during May and June, 1924.

Amorphosomus marmoreus H. Deyrolle.

Amorphosomus marmoreus H. DEYROLLE, Ann. Soc. Ent. Belg. 8 (1864) 127, pl. 4, fig. 14.

A single example of this species was collected on Samar by R. C. McGregor on June 8, 1924.

Cryptodactylus philippinensis Saunders.

Cryptodactylus philippinensis SAUNDERS, Trans. Ent. Soc. London (1874) 321–322.

This species is represented in the United States National Museum by a single example collected on Samar by R. C. McGregor on June 1, 1924.

Cisseicoraebus grandis Kerremans.

Coraebus grandis KERREMANS, Mem. Soc. Ent. Belg. 7 (1900) 77 (separate p. 17).

This species was described from Samar by Kerremans, but no specimen from that island has been examined by me.

Agrilus occipitalis Eschscholtz.

Buprestis occipitalis ESCHSCHOLTZ, Entomographien (1822) 79–80.

This species was described from near Manila, Luzon, by Eschscholtz, but there is a single male in the United States National Museum collected on Samar by R. C. McGregor on May 31, 1924.

Agrilus mcgregori sp. nov.

Female.—Form elongate and moderately robust, subopaque; head blackish green; pronotum cupreous, with a distinct aureous tinge; elytra olivaceous green; beneath bronzy green, and slightly more shining than above.

Head with the front rather narrow, feebly convex, distinctly narrower at base than at apex, with a slight longitudinal depression at vertex, a broad, obsolete depression behind the epistoma, and a narrow longitudinal groove extending from the occiput to near the epistoma; lateral margins strongly, obliquely narrowed from the base to vertex, where they are arcuately rounded, then nearly parallel to the apex; surface coarsely punctate, densely, coarsely rugose, the rugæ transverse in front but becoming concentrical on each side of the occiput, and sparsely clothed with short, erect, inconspicuous hairs; epistoma wide between the antennæ, and nearly truncate in front; antennæ aëneous, extending nearly to middle of pronotum, serrate from the fourth joint, and the outer joints slightly wider than long; eyes large, strongly convex laterally, and more broadly rounded beneath than above.

Pronotum one-half wider than long, base and apex about equal in width, and widest in front of middle; sides feebly, arcuately rounded from apex to behind the middle; then more obliquely narrowed to the posterior angles, which are rectangular; when viewed from the side the marginal carina is strongly sinuate, the submarginal carina strongly sinuate and obliterated anteriorly, the two carinæ widely separated at middle and connected to each other near base; anterior margin strongly sinuate, with the median lobe broadly rounded; base feebly emarginate at the middle of each elytron, and the median lobe broadly truncate in front of scutellum; disk moderately convex, without distinct median depression but with a broad, deep depression on each side extending from the lateral margin obliquely backward to near the base, and a sharply defined arcuate prehumeral carina extending from the base to the marginal carina near middle; surface with densely placed, transverse asperities, and the intervals with numerous fine punctures, from which arises a short, erect, inconspicuous hair. Scutellum with a sharply defined, sinuate, transverse carina, and the surface densely reticulate.

Elytra slightly wider than pronotum at base, and about equal in width at base and just behind the middle; sides nearly parallel for a short distance behind the base, rather strongly, broadly, arcuately constricted in front of middle, broadly, arcuately expanded behind the middle, then obliquely narrowed to the tips which are produced into a long spine at the middle of each elytron; sides of abdomen broadly exposed above; disk rather strongly convex, feebly, broadly flattened on median part and along sutural margins toward apex, and with broad, shallow basal depressions; surface densely, finely imbricate-punctate, becoming coarsely granulose toward the base, and sparsely clothed with fine, inconspicuous hairs.

Abdomen beneath sparsely, finely punctate, becoming transversely rugose on basal segment, and sparsely clothed with short, recumbent, cinereous hairs; first and second segments convex at middle and without a median groove; last segment broadly rounded at apex; vertical portions of segments rather densely clothed with long, recumbent, golden yellow pubescence; pygidium longitudinally carinate but the carina not projecting. Episternum and lateral side of posterior coxæ densely clothed with long, recumbent, golden yellow pubescence. Prosternum rather densely, coarsely granulose, and sparsely clothed with short, semierect, cinereous hairs; prosternal lobe broad, moderately declivous, and broadly rounded in front, with a broad, deep, arcuate emargination at the middle; prosternal process broad, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex which is acute. Tibiæ slender, straight, anterior and middle pairs with a short tooth on the inner margin at apex, and the anterior pair simple. Posterior tarsi distinctly shorter than tibiæ, and the first joint about equal in length to the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the teeth nearly equal in length, and the inner tooth slightly turned inward at the tip, but the tips widely separated.

Length, 7 millimeters; width, 2.

Type locality.—Samar Island, Philippines.

Type.—Catalogue No. 28744, United States National Museum.

Described from a single female collected by R. C. McGregor on Samar, Philippines, on June 21, 1924.

This species is closely allied to *quadriplagiatus* Fisher and *spinellifer* Obenberger. From the former it can be distinguished by the absence of pubescent spots on the elytra, and from the latter in having the elytra of a uniform olivaceous green color, and the pronotum with distinct prehumeral carinæ.

Sambus auricolor Saunders.

Sambus auricolor SAUNDERS, Trans. Ent. Soc. London (1874) 322–323.

This species was described from Samar by Edward Saunders, but no specimen from that island has been examined by me.

DIE STAPHYLINIDEN DER PHILIPPINEN

21. BEITRAG ZUR INDO-MALAYISCHEN STAPHYLINIDENFAUNA

Von MAX BERNHAUER

Öff. Notar in Horn, Nied. Oesterreich

In den letzten Jahren erhielt ich von unserem bekannten Philippinenforscher Prof. C. F. Baker eine reiche Auslese seiner Staphylinidenausbeute von den Philippinen mit vielen neuen Arten. Ausserdem übergab mir die grosse Naturalienhandlung Dr. O. Staudinger & A. Bang-Haas aus Blasewitz-Dresden eine überaus grosse und reichhaltige Staphylinidensammlung des Herrn Böttcher von den Philippinen, in welcher sich ebenfalls eine ganze Reihe neuer Arten befanden, so dass sich bereits ein recht anschauliches Bild der Philippinischen Staphylinidenfauna ergibt.

Ich will daher nunmehr daran gehen, nach und nach Bestimmungstabellen der einzelnen Genera zu verfassen und sie der Oeffentlichkeit übergeben.

Tribus PIESTINI

Genus **EUPIESTUS** Kraatz

1. Halsschildrippen glänzend, Körper klein, 2.5 Millimeter. LUZON, Burauen; Mount Banahao (*Böttcher*). MINDANAO, Provinz Lanao, Iligan (*Baker*) .... **E. sculpticollis Kraatz.**

   Halsschildrippen nicht glänzend, Körper grösser, 2.8 bis 3.5 Millimeter .... 2.

2. Weib, Flügeldecken viel länger als der Halsschild, pechbraun mit etwas rötlichen Flügeldecken, die Wurzel der Fühler, die Taster und Beine rostgelb. Kopf schmäler als der Halsschild mit grossen ziemlich vorgequollenen Augen, hinter diesen plötzlich verengt mit sehr kurzen Schläfen, die Scheitelfurche unbestimmt. Fühler kurz, vom fünften Gliede an stärker erweitert, dieses und die folgenden Glieder quer, das Endglied konisch. Halsschild länger als breit mit spitzigen Vorder und Hinterecken, der Seitenzahn ebenfalls spitzig. Flügeldecken um ein gutes Stück länger als der Halsschild und viel breiter als dieser, etwas länger als zusammen breit, ziemlich glänzend mit feinen Rippen und sehr breiten, weitläufig punktierten Zwischenräumen. Hinterleib ziemlich fein und dicht punktiert und schwach

beschuppt. Länge, 2.8 Millimeter. LUZON, Provinz Nueva Vizcaya, Imugan (*Böttcher*). Ein einziges Weib .... **E. luzonicus sp. nov.**

Flügeldecken wenig länger als der Halsschild, Augen flach, nicht vorragend, Seitenzahn des Halsschildes stumpf verrundet .... 3.

3. Körper grösser, 3.5 Millimeter, Fühler länger, die vorletzten Glieder beim Mann viel länger als breit, beim Weib so lang als breit. LUZON, Mount Banahao: Provinz Nueva Vizcaya, Imugan. MASBATE, Aroroy (*Böttcher*) .... **E. longicornis Fauvel.**[1]

Körper kleiner, 3 bis 3.2 Millimeter, Fühler kürzer, die vorletzten Glieder beim Mann so lang als breit, beim Weib stark quer, Kopf mit deutlichen, nach hinten nicht erweiterten Schläfen, der Seitenzahn des Halsschildes nur als flacher Vorsprung angedeutet, der Körper bei reinen Stücken dicht grau beschuppt, matt. LUZON, Mount Maquiling, Mount Banahao (*Baker*) .... **E. philippinus sp. nov.**

Genus **ELEUSIS** Castelnau

1. Kopf hinten scharf quer gefurcht, der Scheitel erhoben und durch eine kurze scharfe Furche in zwei Teile geteilt. Färbung heller oder dunkler rostfarben, der hintere Teil der Flügeldecken und oft ein Gürtel vor der Spitze dunkler .... 2.

Kopf hinten höchstens mit einer sehr feinen Querlinie .... 6.

2. Die seitlichen Kopffurchen hinter den Augen nach aussen gebogen .... 3.

Die seitlichen Kopffurchen fast gerade streichend .... 5.

3. Sehr grosse Art, der Halsschild fast dreimal breiter als lang, der Vorderrand mit zwei ziemlich tiefen Ausrandungen, der Kopf stark nach rückwärts erweitert. Rostbraun bis hell rostrot, die hintere Partie der Flügeldecken breit schwarz bis pechbraun, die Beine rostrot. Kopf beim Mann meist breiter, beim Weib meist etwas schmäler als der Halsschild, ziemlich matt chagriniert, sehr fein, aber deutlich und namentlich rückwarts nicht allzu weitläufig punktiert, die Scheitelfurchen tief und ziemlich breit, die Furche neben den Augen reicht viel weiter nach rückwärts als der grosse Schläfenpunkt. Halsschild vorn tief zweibuchtig, die Gestalt eines flachen Kreisabschnittes bildend, die Hinterecken durch einen grossen, durch einen Einschnitt des Seitenrandes gebildeten Zahnes angedeutet, meist mit zwei breiten, flachen Eindrücken, fein und namentlich in der Mitte nicht zu weitläufig punktiert, ähnlich wie der Kopf gestrichelt, am Vorderrand jederseits mit zwei grossen Punkten und einem scharfen schiefen Strich. Flügeldecken länger als der Halsschild, auf der Scheibe mit zwei hinter einander stehenden Punkten, viel weitläufiger gestrichelt, ziemlich glänzend, fein und weitläufig punktiert, neben dem Seitenrand mit einer Längsfurche, deren äusserer Rand wulstförmig erhoben ist. Hinterleib mit einzelnen Punkten, äusserst fein quergestrichelt. LUZON, Provinz Nueva Vizcaya, Imugan (*Böttcher*). Länge, 8 bis 11 Millimeter .... **E. phaenomenalis sp. nov.**

Mittelgrosse Arten, der Halsschild ungefähr doppelt so breit als lang, mehr oder minder halbkreisförmig, der Vorderrand schwächer zweibuchtig, die Färbung meist heller, mehr rötlichgelb, der Kopf nach rückwarts höchstens schwach erweitert.. 4.

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[1] Ob diese Art tatsächlich mit der aus Sumatra beschriebenen *longicornis* identisch ist, kann ich mit vollster Sicherheit nicht feststellen, da mir diese Art bisher fehlte. Die Beschreibung stimmt in allen Punkten überein.

4. Halsschild etwas mehr als doppelt so breit als lang, nicht ganz halbkreisförmig, der Kopf beim Mann schwach erweitert, beim Weib nach rückwärts gerundet verengt, die Augenfurchen sammt dem Längswulst weiter nach rückwärts reichend als der grosse Schläfenpunkt, die Längsfurche am Scheitel stärker, die Flügeldecken meist mit zwei Punkten, seltener mit einem Punkt und dann zugleich kürzer. Halsschild dichter gestrichelt, matter. Länge, 6 bis 8 Millimeter. LUZON, Provinz Nueva Vizcaya, Imugan: Provinz Mountain, Mount Polis; Balbalan.. **E. luzonicus sp. nov.**

Halsschild kaum doppelt so breit als lang, fast ganz halbkreisförmig, der Kopf nach rückwärts nicht erweitert, die Augenfurchen nur bis zu dem Schläfenpunkt reichend, die Längsfurche am Scheitel schmäler und weniger tief, die Flügeldecken nur mit einem Punkt, zusammen nur wenig länger als breit. Halsschild weitläufig gestrichelt und stark glänzend. Länge, 5 bis 6 Millimeter. LUZON, Mount Banahao (*Baker*): Provinz Nueva Vizcaya, Imugan (*Böttcher*).. **E. sulciceps sp. nov.**

5. Von der Grösse und Färbung des *luzonicus* m., die letztere ebenso veränderlich vom rostgelb bis zum dunklen rostbraun, der Kopf länger, nach hinten unmerklich (Mann) oder gar nicht (Weib) erweitert, mit kleineren Augen und viel längeren Schläfen, die seitlichen Kopffurchen neben den Augen und die an deren Aussenseiten abgesetzten Kiele geradlinig nach hinten verlaufend und nur bis zum grossen Schläfenpunkt reichend. Halsschild weniger kurz, nicht ganz doppelt so breit als lang, die Ausbuchtung an den Seiten und die dadurch gebildeten Zähne viel stärker. Länge, 7.5 bis 8.5 Millimeter. LUZON, Provinz Mountain, Pauai (Haight's Place); Mount Polis (*Böttcher*).. **E. augustae sp. nov.**

6. Kopf beim Mann nach rückwärts stark, beim Weib nur schwach oder kaum erweitert, so breit als lang, äusserst fein gestrichelt und fein und spärlich, längs dem Hinterrande dichter punktiert, die Augenrandfurche sehr lang und scharf und aussen scharfgekielt, in der Mittellinie ist eine schwache Längsfurche angedeutet. Der Kopf ist beim Mann breiter als der Halsschild, beim Weib so breit oder sogar etwas schmäler als dieser. Halsschild wenig dicht gestrichelt, stark glänzend, sehr spärlich und äusserst fein punktiert, fast um die Hälfte breiter als lang, das Seitenzähnchen scharf, die Mittellinie äusserst schmal kielförmig erhoben. Flügeldecken nur wenig länger als der Halsschild, zusammen so lang als breit, nach rückwärts schwach erweitert, äusserst fein und spärlich gestrichelt und kaum wahrnehmbar punktiert, stark glänzend. Hinterleib ausser den normalen Basalpunkten an den Seiten der Tergite mit einigen wenigen Punkten. Pechbraun, die Flügeldecken bis auf den schwärzlichen Spitzenrand schwärzlich, Fühler, Taster und Beine dunkel rostrot. Länge, 3.5 bis 5 Millimeter. LUZON, Provinz Laguna, Los Baños (*Böttcher*).. **E. divergens sp. nov.**

Kopf auch beim Mann nach rückwarts nicht oder nur wenig erweitert .... 7.

7. Flügeldecken zusammengenommen höchstens um ein Drittel länger als breit .... 8.
Flügeldecken zusammengenommen mindestens um die Hälfte länger als breit .... 34.

8. Kopf wenigstens beim Mann gleichbreit, rechteckig .... 9.
Kopf bei beiden Geschlechtern rundlich, meist deutlich breiter als lang .... 19.

9. Kopf länger als breit (von der Mitte des Clypeus bis zum Halsschildrande gemessen) .... 10.
Kopf nicht länger als breit .... 17.

10. Hinterleib äusserst dicht und stark lederartig gewirkt, matt, Kopf vor dem Hinterrande mit einem schwachen Quereindruck .... 11.
Hinterleib weitläufig gestrichelt, glänzend, Kopf ohne Quereindruck am Halse .... 13.

11. Vorderkörper sehr stark glänzend, bei Lupenvergrösserung ohne erkennbare Strichelung. Schwarz, die Fühler, Taster und Beine, sowie die Flügeldecken bis auf den breiten dunklen Hinterrand rötlichgelb. Kopf regelmässig rechteckig, fein und weitläufig punktiert, die Augenrandfurche sehr weit nach rückwärts reichend, die vorletzten Fühlerglieder schwach quer. Halsschild um ein Viertel breiter als lang, mit einem scharfen Zähnchen hinter der Mitte, auf der Scheibe kräftiger, aber nicht dichter als den Kopf punktiert. Flügeldecken um ein Drittel länger als breit, mit einem grösseren Punkt und einer Anzahl sehr feiner Pünktchen, ohne Chagrinierung. Länge, 3.6 mm. LUZON, Provinz Mountain, Balbalasang (*Böttcher*). Ein einziges Stück .... **E. speculipennis sp. nov.**
Vorderkörper wenig glänzend, sehr deutlich und sehr dicht gestrichelt .... 12.

12. Flügeldecken ungefähr um ein Viertel länger als breit, die dunkle Partie auf der hinteren Hälfte ungefähr ein Drittel der Länge einnehmend, Vorderkörper deutlich weitläufig punktiert, Kopf deutlich länger, das seitliche Halsschildzähnchen grösser und spitziger, die Färbung ähnlich wie bei dem vorhergehenden, die Beine jedoch etwas angedunkelt, der Kopf nach rückwarts vollkommen gleichbreit, der Körper breiter und grösser. Länge, 5 Millimeter. LUZON, Provinz Mountain, Mount Polis (*Böttcher*). Ein einziges Stück. **E. quadraticeps sp. nov.**
Flügeldecken nur ungefähr ein Fünftel länger als breit, die dunkle Apicalpartie die Hälfte der Länge einnehmend, Vorderkörper ohne deutliche Punktierung, Kopf kürzer, nur sehr wenig länger als breit, nach rückwarts äusserst schwach verbreitert, die dunkle Färbung mehr pechbraun, Beine angedunkelt, Körper schmäler und kleiner. Länge, 4.5 Millimeter. LUZON, ein Stück vom gleichen Fundorte. **E. alutiventris sp. nov.**

13. Kopf deutlich und ziemlich dicht, wie mit einer Nadel scharf geritzt .... 14.
Kopf nicht scharf nadelrissig, sondern gewöhnlich gestrichelt .... 15.

14. Halsschild auf der Scheibe ohne Strichelung, glänzend glatt, der Kopf stellenweise weitläufiger geritzt, die vorletzten Fühlerglieder deutlich quer. Körper grösser und breiter. Grundfärbung heller oder dunkel

pechfarben, vom dunklen pechbraun bis zum schmutziggelb, der Kopf aber immer etwas dunkler, die Flügeldecken bis auf den dunklen Hinterrand rötlichgelb. Länge, 3.5 bis 4 Millimeter. LUZON, Provinz Mountain, Lubuagan: Provinz Camarines Sur, Mount Isarog: Provinz Laguna, Los Baños: Provinz Ilocos Norte, Bangui. MINDANAO, Provinz Lanao, Mumungan (*Böttcher*). In einer Anzahl von Stücken erbeutet.. **E. strigiceps sp. nov.**

Halsschild mit feiner, aber deutlicher Strichelung, mässig glänzend, der Kopf viel dichter und gleichmässiger geritzt, vorn stellenweise quer gestrichelt, die vorletzten Fühlerglieder nicht breiter als lang. Körper etwas kleiner und schmäler. Grundfärbung, hell rötlichgelb mit schwach angedunkelter Apikalpartie der Flügeldecken. Länge, 3 bis 3.5 Millimeter. PALAWAN, Binaluan (*Böttcher*). Zwei Stücke. **E. palawanensis sp. nov.**

15. Körper grösser, Kopf auf der Mitte der Scheibe ohne Grundskulptur, stark glänzend, vorn ziemlich kräftig punktiert.... **E. discalis Fauvel.**

Körper kleiner, überall ziemlich dicht längsgestrichelt, wenig glänzend .... 16.

16. Körper einfarbig bräunlich einschliesslich der Fühler und Taster, mit dunklerem Kopf; dieser nur sehr wenig länger als breit, die Schläfen nur wenig länger als der Längsdurchmesser der Augen. Halsschild deutlich quer, nach rückwarts gleichmässig gerundet verengt, ohne seitliches Zähnchen; die Flügeldecken viel länger als der Halsschild, um ein Drittel länger als zusammen breit. Länge, 3 Millimeter. MINDANAO, Provinz Lanao, Mumungan (*Böttcher*). Ein einziges Stück.. **E. brunnea sp. nov.**

Körper pechschwarz bis pechbraun mit rostfarbigen Fühlern und Beinen, die Flügeldecken hell rötlichgelb mit dunklem Hinterrande; Kopf viel länger als breit, biem Mann langgestreckt, regelmässig rechteckig, beim Weib mehr länglich eiförmig nach hinten sanft gerundet verengt, die Schläfen beim Mann viel, beim Weib wenig länger als der Längsdurchmesser der Augen; Halsschild fast länger als breit, nach rückwärts flacher verengt, mit deutlichem Seitenzähnchen; Flügeldecken nur wenig länger als der Halsschild, nur ungefähr ein Viertel länger als zusammen breit. Länge, 2.5 bis 3 Millimeter. LUZON, Provinz Camarines Sur, Mount Isarog: Provinz Bataan, Limay. MINDANAO, Provinz Lanao, Mumungan. PALAWAN, Binaluan. BASILAN. MINDORO, San Teodoro. MASBATE, Aroroy (*Böttcher*).. **E. angusticeps sp. nov.**

17. Kopf heller oder dunkler gelb sowie der übrige Körper bis auf dem dunklen Hinterrand der Flügeldecken, der Hinterleib oft ganz oder teilweise etwas dunkler. Kopf beim Mann gleichbreit, so breit als der Halsschild, beim Weib mehr gerundet und etwas schmäler, in beiden Geschlechtern etwas breiter als lang, deutlich gestrichelt; Fühler ziemlich kurz, die vorletzten Glieder schwach quer. Halsschild so lang als breit, mit kaum angedeuteten seitlichen Zähnchen, stark glänzend, mit kaum wahrnehmbarer Strichelung. Flügeldecken wenig länger als zusammen breit. Länge, 2.5 Millimeter., LUZON, Provinz Camarines Sur, Mount Isarog: Provinz Laguna, Los Baños (*Böttcher*).. **E. flaviceps sp. nov.**

Kopf schwarz.. 18.

18. Kleiner. Halsschild rotgelb, Flügeldecken lichter gelb, das apikale Drittel, der Kopf und das schmutzig-gelbe Abdomen vor der Spitze schwarz, die Fühler, Taster und Beine lebhaft rötlichgelb. Kopf etwas breiter als der Halsschild, deutlich breiter als lang, nach rückwärts geradlinig, unmerklich verengt, deutlich längsgestrichelt mit eingestreuten sehr feinen Pünktchen; die vorletzten Fühlerglieder schwach quer. Halsschild breiter als lang, mit äusserst schwach entwickeltem Seitenzähnchen, schwer sichtbar gestrichelt und spärlich aber deutlich punktiert. Flügeldecken viel länger als der Halsschild, um ein Drittel länger als zusammen breit, mit je einem Punkte und kaum wahrnehmbarer Grundskulptur. Länge, 3.5 Millimeter. LUZON, Provinz Mountain, Balbalasang (*Böttcher*). Ein einzelnes Stück .... **E. atriceps sp. nov.**

Grösser und breiter. Körper schwarz mit pechbraunen Beinen und Tastern, Flügeldecken bis auf den dunklen Hinter- und Seitenrand rötlichgelb. Kopf beim Mann etwas schmäler als der Halsschild, etwas breiter als lang, Seiten hinten vollständig parallel, beim Weib viel kleiner, rundlich, rückwärts verhältnismässig stark eingeschnürt, bei Lupenvergrösserung ohne wahrnehmbare Grundskulptur und ohne Punktierung, spiegelblank, die Fühler lang und schlank, die vorletzten Glieder nicht breiter als lang. Halsschild so lang als breit, ohne deutliches Seitenzähnchen, an dessen Stelle sich nur eine unmerkliche Einkerbung befindet, Grundskulptur schwer sichtbar und sehr spärlich, ohne Punktierung. Flügeldecken nur mässig länger als der Halsschild, höchstens ein Viertel länger als zusammen breit, mit undeutlicher Grundskulptur. Länge, 4.2 Millimeter. MASBATE, Aroroy (*Böttcher*). Ein Stück .... **E. speculiceps sp. nov.**

19. Grösser als 2.5 Millimeter .... 20.

Kleiner als 2.5 Millimeter .... 29.

20. Kopf schwarz .... 23.

Kopf gelb, wie der übrige Körper mit Ausnahme der angedunkelten Apikalpartie der Flügeldecken .... 21.

21. Fühler stark verdickt, die vorletzten Glieder fast um die Hälfte breiter als lang, das fünfte viel breiter als das vierte, ziemlich stark quer. Kopf mit den stark vorgequollenen Augen so breit als der Halsschild, wie der übrige Körper sehr stark glänzend, stark quer, die Schläfen hinter den Augen sehr klein, die Scheibe bei dem einzigen bisher vorliegenden Stück uneben, hinten mit kurzer Mittelfurche, neben dieser rückwärts jederseits schwach beulenartig erhoben. Halsschild fast länger als breit, stark ausgehöhlt, uneben seitlich ohne deutliches Zähnchen. Flügeldecken etwa um ein Viertel länger als zusammen breit. Länge, 2.8 Millimeter. LUZON, Provinz Laguna, Los Baños (*Böttcher*) .... **E. crassicornis sp. nov.**

Fühler normal, fadenförmig, die vorletzten Glieder nicht oder kaum quer .... 22.

22. Kopf kaum breiter als der Halsschild, ziemlich rundlich, gleich hinter den Augen in flachem Bogen verengt, hinten sehr fein längsgestrichelt, vorn mehr schräg und stellenweise, namentlich vor dem Vorderrande, quer schraffiert, die vorletzten Fühlerglieder nicht quer. Halsschild so lang als breit, mit sehr kleinem Seitenzähnchen, auf der Scheibe ausgehöhlt[2] äusserst fein und weitläufig gestrichelt. Flügeldecken wenig länger als der Halsschild, nur wenig länger als zusammen breit, mit dem normalen Punkt, Grundskulptur äusserst schwach. Länge, 3 Millimeter. MINDANAO, Provinz Lanao, Mumungan (*Böttcher*). Ein Exemplar.. **E. rufotestacea sp. nov.**

Kopf beim Mann viel breiter als der Halsschild, quer elliptisch. **E. kraatzi Fauvel.**

23. Halsschild rotgelb. Ganz von der Färbung der *atriceps*, jedoch auf den ersten Blick durch viel kürzeren Kopf, kürzeren Halsschild und kürzere Flügeldecken zu unterscheiden. In der Körpergestalt der *rufotestacea* sehr ähnlich, durch die Färbung, dichtere und deutlichere Strichelung des Kopfes und durch längere Flügeldecken verschieden. Länge, 3.1 Millimeter. LUZON, Provinz Mountain, Balbalasang (*Böttcher*). Ein Stück. **E. obscuriceps sp. nov.**

Halsschild dunkel.. 24.

24. Kopf deutlich punktiert, Körper von der Färbung des *angusticeps* m.. 25.

Kopf nicht oder kaum punktiert.. 27.

25. Kopf beim Mann breiter als der Halsschild.. 26.

Kopf beim Mann nicht breiter als der Halsschild, rundlich, nur sehr wenig breiter als lang, hinter den Augen beim Mann zuerst eine kurze Strecke geradlinig,[3] dann erst gerundet verengt, weitläufig punktiert, Grundskulptur deutlich, vorletzte Fühlerglieder fast breiter als lang. Halsschild quer, um ein gutes Stück breiter als lang, mit deutlichen Seitenzähnchen, deutlich chagriniert. Flügeldecken mässig länger als der Halsschild, kaum länger als zusammen breit. Länge, 3 bis 3.2 Millimeter. LUZON, Provinz Laguna, Los Baños (*Baker*, *Böttcher*).. **E. banosana sp. nov.**

26. Kopf kräftiger und dichter punktiert, Grundskulptur dichter, die Oberseite weniger glänzend, der Kopf etwas breiter, die vorletzten Fühlerglieder fast breiter als lang, Flügeldecken nur um ein Viertel länger als zusammen breit. Länge, 3.2 Millimeter. LUZON, Provinz Mountain, Balbalan (*Böttcher*).. **E. sculpticeps sp. nov.**

Kopf weniger kräftig und sehr spärlich punktiert, Grundskulptur weniger dicht, Oberseite glänzender, die vorletzten Fühlerglieder nicht quer, Flügeldecken um ein Drittel länger als zusammen breit. Es ist möglich dass diese Art von der früheren sich nicht als spezifisch verschieden herausstellen könnte, wenn mehr Material beider Arten vorhanden sein wird. Länge, 3 bis 3.5 Millimeter. LUZON, Provinz Mountain, Mount Polis (*Böttcher*).. **E. montana sp. nov.**

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[2] Eine solche Aushöhlung kommt bei vielen *Eleusis*-arten vor, ohne dass sie ein Artmerkmal bilden, da neben ausgehöhlten Stücken solche mit ganz flachem Halsschild vorkommen.

[3] Es ist Gefühlssache, ob man diese Art hierher oder in die Nähe des *speculiceps* stellen will, von welchem sie sich jedoch durch ganz andere Skulptur hinreichend unterscheidet.

27. Flügeldecken braun, die Färbung sonst pechschwarz, die Wurzel der bräunlichen Fühler, die Taster und Beine rötlichgelb, die Schenkel angedunkelt. Kopf beim Mann stark, beim Weib kaum breiter als der Halsschild, beim letzteren sofort hinter den Augen verengt, beim Mann ziemlich erweitert, kurz elliptisch oder fast kreisrund, sowie der übrige Körper stark lackglänzend. Fühler dünn, die vorletzten Glieder nicht quer. Halsschild beim Mann deutlich quer, beim Weib so lang als breit, Flügeldecken nur um ein Viertel länger als zusammen breit. Grundskulptur des ganzen Körpers äusserst schwach, schwer erkennbar. Länge, 3.2 bis 3.5 Millimeter. LUZON, Provinz Laguna, Los Baños (*Böttcher*)............ **E. circuliceps** sp. nov.

Flügeldecken rötlichgelb mit dunklerem Hinterrande........................ 28.

28. Kopf ohne ocellenartige Beulchen, beim Mann viel breiter, beim Weib so breit als der Halsschild, Grundfärbung pechschwarz mit hellen Flügeldecken und rostbräunlichen Fühlern, Tastern und Beinen. Halsschild deutlich quer, ohne Seitenzähnchen, Flügeldecken nur wenig länger als breit, Fühler etwas kürzer, Grundskulptur deutlich dichter. Länge, 3 bis 3.5 Millimeter. LUZON, Burauen. MINDANAO, Provinz Zamboanga, Port Banga: Provinz Lanao, Mumungan (*Böttcher*).. **E. splendida** sp. nov.

Kopf im hinteren Drittel mit zwei glänzend glatten, ocellenartigen Erhabenheiten, beim Weib schmäler als der Halsschild, Grundfärbung braunrot bis rötlichbraun, Flügeldecken hellgelb mit schwärzlichem Hinterrand, Fühler, Taster und Beine lebhaft rötlichgelb. Halsschild länger als breit mit deutlichen Seitenzähnchen. Flügeldecken viel länger als breit. Fühler länger und gestreckter, Grundskulptur weitläufiger, nicht gut sichtbar. Länge, 3 Millimeter. MINDANAO, Provinz Lanao, Mumungan. LUZON, Provinz Nueva Vizcaya, Imugan (*Böttcher*).. **E. ocellatus sp. nov.**

29. Flügeldecken um ein Drittel länger als zusammen breit, lebhaft rotgelb, der Kopf, der rückwärtige vierte Teil der Flügeldecken und ein Gürtel vor der Hinterleibsspitze schwarz, die Oberfläche ohne Unebenheiten, gleichmässig flach gewölbt. Kopf beim Mann so breit als der Halsschild, beim Weib schmäler und kürzer, Halsschild so lang als breit, die Seitenzähnchen kaum angedeutet. Grundskulptur bei schärfster Lupenvergrösserung deutlich. Länge, nicht ganz 2.5 Millimeter. LUZON, Provinz Mountain, Balbalasang (*Böttcher*).
E. alternans sp. nov.

Flügeldecken höchstens um ein Viertel länger als zusammen breit.... 30.

30. Bräunlichgelb, meist mit schwach angedunkeltem Kopf, Halsschild, Flügeldeckenhinterrand und einem Gürtel vor der Hinterleibsspitze. Kopf beim Mann fast breiter, beim Weib schmäler als der Halsschild, beim Mann von der Gestalt eines fast regelmässigen Kreises mit sehr stark entwickelten Schläfen, welche doppelt so lang als der Längsdurchmesser der Augen sind, beim Weib quer, mit kurzen, aber immerhin deutlichen Schläfen; Halsschild fast so lang als breit, nach rückwärts fortlaufend in flachem Bogen verengt, der Seitenzahn nur durch einen Borstenpunkt angedeutet; Flügeldecken höchstens um ein Viertel länger als breit. Grundskulptur meist schwer erkennbar. Länge, 2.5 Millimeter. PALAWAN, Binaluan. MINDORO,

San Teodoro. MINDANAO, Provinz Lanao, Mumungan. LUZON, Provinz Camarines Sur, Mount Isarog (*Böttcher*).......... **E. soror sp. nov.**[4]

Kleiner, höchstens 2 Millimeter.. 31.

31. Körper winzig klein, 1 bis 1.3 Millimeter lang, Augen am Innenrande ohne Längsfurche.. 33.

Körper weniger klein, 2 Millimeter. Augen am Innenrande mit scharfer Längsfurche .... 32.

32. Halsschild lebhaft rotgelb, deutlich quer:

a. Flügeldecken kaum länger als zusammen breit (Stammform).
E. philippinus Bernhauer.

b. Flügeldecken um ein Viertel länger als zusammen breit.
E. philippinus var. longipennis var. nov.

Halsschild rötlichbraun bis schwarz, so lang oder etwas länger als breit, ohne Seitenzähnchen, Kopf beim Mann breiter, beim Weib so breit als der Halsschild, Flügeldecken um ein Viertel länger als breit, ohne Punktierung, Grundskulptur am Kopf deutlich, am Halsschild und auf den Flügeldecken sehr undeutlich. Länge, 2 Millimeter. MINDANAO, Provinz Zamboanga, Port Banga: Provinz Lanao, Mumungan. PALAWAN, Binaluan (*Böttcher*)............. **E. pennata sp. nov.**

Flügeldecken um ein Drittel länger als zusammen breit. PALAWAN, Binaluan (*Böttcher*).............. **E. philippinus var. longelytrata var. nov.**

33. Kopf angedunkelt, deutlich und ziemlich dicht längsgestrichelt, weniger glänzend, beim Mann breiter, beim Weib so breit als der Halsschild, so lang als breit, Flügeldecken um ein Viertel länger als zusammen breit. LEYTE. PALAWAN, Binaluan. SIARGAO. MASBATE, Aroroy. (*Böttcher*).. **E. fusciceps** Kraatz.

Kopf rötlichgelb, nicht oder undeutlich oder weitläufig längsgestrichelt, glänzend, beim Mann nicht oder kaum breiter als der Halsschild. Eine allem Anscheine nach sehr veränderliche Art, welche vielleicht bei Hervorkommen eines grösseren Materiales sich in mehrere Arten wird spalten lassen. Länge, 1 bis 1.3 Millimeter. SIARGAO, Dapa. PALAWAN, Binaluan. LUZON, Provinz Mountain, Balbalasang. MINDANAO, Provinz Lanao, Mumungan. MASBATE, Aroroy (*Böttcher*).
E. banghaasi sp. nov.[5]

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[4] Die Art ist etwas veränderlich und unterscheidet sich im weiblichen Geschlecht von der ähnlich gefärbten *kraatzi* Fauvel durch kleinere Augen und die immerhin deutlicheren Schläfen, beim Mann aber durch ganz andere Kopfbildung.

[5] Bei der typischen Form, welche etwas breiter ist, sind die Flügeldecken nur wenig länger als zusammen breit, der Halsschild etwas breiter als lang, der Kopf beim Mann so lang als breit, die Grundskulptur spärlich und kaum sichtbar, Oberseite sehr stark glänzend.

Bei den verschiedenen übrigen Formen werden die Flügeldecken länger, bis zu einem Drittel länger als breit, der Halsschild ist oft länger als breit, auch der Kopf des Mannes ist bisweilen viel länger als breit, die Grundskulptur ist eine veränderliche und oft sehr deutlich, aber immer spärlich, bisweilen tritt sie entgegen den übrigen Formen auf den Flügeldecken deutlich hervor (var. *exigua* m.).

Diese Formen gehen so bizarr durcheinander, das es erst auf Grund eines grossen Materiales möglich sein wird ein abschliessendes Urteil über eine allfällige Artberechtigung einzelner dieser Formen zu gewinnen.

34. Hinterleib glänzend, ziemlich weitläufig quergestrichelt, Kopf ziemlich stark quer, stark eingeschnürt, vor dem Halse scharf quergefurcht, bei beiden Geschlechtern viel breiter als der Halsschild, der Vorderkörper einschliesslich der Flügeldecken deutlich irisierend. Kopf und Halsschild äusserst fein und sehr spärlich punktiert. Flügeldecken mit je zwei in einer Längsreihe stehenden Dorsalpunkten. Grundskulptur am Kopf deutlicher, sonst sehr schwer sichtbar. Die vorletzten Fühlerglieder schwach quer. Augenfurchen kurz, hinten stark nach innen gebogen. Der Körper ist schwarz, die Flügeldecken bräunlichgelb, das hintere Drittel angedunkelt, Fühler, Taster und Beine rötlichgelb. Länge, 3.5 bis 4 Millimeter. MINDANAO, Provinz Zamboanga, Dapitan (*Baker*). LUZON, Provinz Mountain, Pauai (Haight's Place) .... **E. iridescens sp. nov.**[6]

Hinterleib ziemlich matt, sehr dicht lederartig gewirkt, vor dem Halse nicht scharf gefurcht, bei beiden Geschlechtern nicht oder nur wenig breiter als der Halsschild, der Vorderkörper nicht irisierend, Flügeldecken nur mit einem feinen Diskalpunkt .... 35.

35. Kopf ziemlich dicht und kräftig punktiert, beim Mann kaum länger als breit, rundlich, hinten abgeschnürt. Schläfen nicht doppelt so lang als der Längsdurchmesser der Augen, Halsschild deutlich, ziemlich kräftig punktiert, auf der hinteren Hälfte jederseits mit einem kurzen, aber tiefen Längseindruck. Grundskulptur stark und dicht. Färbung wie der vorige. Länge, 3.2 bis 3.5 Millimeter. LUZON, Provinz Mountain, Pauai (Haight's Place) .... **E. densiceps sp. nov.**

Kopf nicht oder nur einzeln punktiert, beim Mann viel länger als breit, hinter den Augen geradlinig, unmerklich erweitert, lang rechteckig, hinten nur wenig eingeschnürt. Schläfen mehr als doppelt so lang als der Längsdurchmesser der Augen. Beim Weib ist der Kopf viel kleiner, kürzer, mehr rundlich, mit kürzeren Schläfen. Halsschild nicht punktiert, ohne die kurzen Furchen, Grundskulptur deutlich und dicht, namentlich am Hinterleib viel stärker als bei der früheren Art. Färbung dieselbe. Länge, 3.2 bis 4 Millimeter. Vom selben Fundorte .... **E. paralleliceps sp. nov.**

Genus **THORACOCHIRUS** Bernhauer

1. Halsschild mit groben Nabelpunkten besetzt .... 4.

Halsschild fein punktiert .... 2.

2. Halsschild sehr dicht punktiert, ohne Glanz. (Ich beziehe auf diese auf Luzon (Butao) gesammelte Art den mir in einem authentischen Stück bisher nicht vorgelegenen.) .... **T. raffrayi** Fauvel.[7]

Halsschild nicht sehr dicht punktiert, glänzend .... 3.

3. Grösser, Kopf und Halsschild fein, letzterer ziemlich dicht punktiert, Flügeldecken grob gekörnt. Länge, 3.5 bis 4 Millimeter. LUZON, Pro-

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[6] Ein Stück vom Mount Polis (Luzon) besitzt nur je einen Dorsalpunkt, ein klein wenig kürzere, nur im ersten Drittel bräunlichgelbe Flügeldecken, ohne dass ich dieses Tier für eine eigene Art ansprechen kann.

[7] Diese Art wurde auch auf Formosa von Sauter aufgefunden und von mir nach einem von Eppelsheim bestimmten Stück ursprünglich als *variolosus* Fauvel determiniert.

vinz Laguna, Mount Maquiling (*Baker*). MINDANAO, Subaan. MASBATE, Aroroy. SIARGAO (*Böttcher*). Sonst Mentawei. BORNEO.
T. nanus Heller.

Kleiner. Kopf und Halsschild sehr fein, letzteres sehr weitläufig punktiert, nach rückwärts nicht verengt mit einem deutlichen Zähnchen in den Hinterecken, Flügeldecken etwas kürzer, weniger grob und etwas weitläufiger, deutlich runzeliger gekörnt. Die kleinste, bisher bekannte Art. Länge, 2.3 bis 2.5 Millimeter. BILIRAN (*Böttcher*). Bisher zwei Stück bekannt................................ **T. minutissimus sp. nov.**

4. Länge, 5 bis 6 Millimeter.

*a*¹. Halsschild sehr uneben, sehr grob und verhältnismässig dicht genabelt punktiert. MINDORO, Subaan. BILIRAN. (Stammform.)
T. variolosus Fauvel.[8]

*a*². Halsschild mit mehr oder minder ausgedehnten Spiegelflecken zwischen den Punkten.

*b*¹. Flügeldecken etwas kürzer als lang, grob gekörnt, häufig bräunlichgelb. BILIRAN (*Böttcher*). LUZON, Provinz Laguna, Mount Maquiling; Los Baños. SAMAR. BORNEO (*Baker*).
T. v. var. intermedius var. nov.

*b*². Flügeldecken so lang als breit, schwach gekörnt, Flügeldecken tiefschwarz. SUMATRA (*Förster*).
T. v. var. foersteri Bernhauer.

*b*³. Halsschild grösstenteils glänzend glatt, eben, nur mit spärlichen Nabelpunkten besetzt, die sich meist an der Naht und hinter dem Vorderrande befinden. BILIRAN (*Böttcher*).
T. v. var. sublaevicollis var. nov.

Genus **PARALISPINUS** Bernhauer

Paralispinus exiguus Er. var. obscuripennis var. nov.

Diese Form unterscheidet sich von der einfarbig rötlichgelben Stammform durch schwärzliche Flügeldecken und bildet so den Uebergang zur einfärbig pechbraunen var. *piceus* Fauvel.

Subgenus **Clavilispinus** novum

Die neue Untergattung unterscheidet sich von den übrigen Arten sehr durch die plötzlich verdickten drei letzten Fühlerglieder, welche eine stark abgesetzte Fühlerkeule bilden.

Paralispinus (Clavilispinus) siargaoanus sp. nov.

Von *exiguus* Er. durch grössere Gestalt, viel längeren, nach rückwärts deutlich und geradlinig erweiterten Kopf, vorn gerade und sehr breit abgestutzten, in der Mitte eine kleine

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[8] Es liegen eine grosse Zahl hierher gehöriger Stücke vor, welche ich nach der Beschreibung für den von Fauvel aus Ostindien beschriebenen *variolosus* halten muss. Die vorliegende Art variiert in einer solchen Weise dass man beim Vergleiche der extremsten Stücke unbedingt glauben müsste, man habe es mit mehreren Arten zu tun. Da jedoch alle möglichen Uebergänge zwischen den einzelnen Formen vorliegen, haben wir es hier nur mit einer äusserst veränderlichen Art zu tun.

Ausrandung zeigenden Clypeus, kleinere flachere Augen, viel längere Schläfen, die ganz anders gebildeten Fühler, längerer, an den Seiten geradlinigen, nach rückwärts schwach verengten Halsschild und den stärkeren Glanz des Vorderkörpers auf den ersten Blick zu unterscheiden. Kopf, Halsschild und Flügeldecken besitzen kaum eine wahrnehmbare Grundskulptur. Die Fühler sind sehr kurz, die Glieder vom vierten angefangen quer, das neunte, zehnte und elfte Glied stark erweitert, knopfförmig.

Die Färbung ist pechbraun, die Fühler, Beine und der Mund sind rostrot. Länge, 2.5 Millimeter.

SIARGAO, Dapa (*Böttcher*).

Genus **HOLOSUS** Motschulsky

1. Halsschild schmäler als die Flügeldecken, hinter der Mitte ausgeschweift. Punktierung grob .... 2.

   Halsschild nicht oder kaum schmäler als die Flügeldecken, hinter der Mitte kaum ausgebuchtet. Punktierung fein oder fehlend .... 5.

2. Flügeldecken länger als der Halsschild, dieser beträchtlich schmäler als die Flügeldecken .... 3.

   Flügeldecken kürzer als der Halsschild, Körper kurz und breit, Kopf und Halsschild grob, ersterer sehr dicht, letzterer dicht punktiert, im Grunde glänzend ohne deutlich sichtbare Chagrinierung. Fühler kurz und dick, die vorletzten Glieder stark quer, um die Hälfte breiter als lang. Flügeldecken etwas feiner und weitläufiger punktiert, deutlicher chagriniert, ziemlich uneben. Halsschild wenig schmäler als die Decken, vor den Hinterecken flach eingedrückt, vor dem Schildchen nur unmerklich niedergedrückt. Hinterleib ziemlich matt chagriniert, nur mit sehr spärlichen und undeutlichen Schrägstrichen. Länge, 3.5 bis 4 Millimeter. MINDANAO, Provinz Surigao, Surigao (*Böttcher*) .... **H. paradosus** sp. nov.

3. Halsschild ausser dem tiefen Längseindruck vor den Hinterecken ohne jeden Eindruck, eben, ohne erkennbare Grundskulptur, glänzend, Flügeldecken neben dem Nahtstreifen ohne schwielenartige Erhabenheit. Dem *foveolatus* Motschulsky sehr nahe stehend, von ihm durch viel breiteren und kürzeren Halsschild, schwächer ausgebuchtete Seiten und durch vollständiges Fehlen eines Eindruckes vor dem Schildchen, endlich durch kürzere, stärker und dichter punktierte Flügeldecken leicht zu unterscheiden. Länge, 4.5 Millimeter. MINDANAO, Provinz Lanao, Mumungan. Ein Exemplar. **H. socius** sp. nov.[9]

   Halsschild auch vor dem Schildchen mit je einem deutlichen Längseindruck, deutlich chagriniert, Flügeldecken neben dem Nahtstreifen mit einer schwielenartigen Erhabenheit .... 4.

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[9] Dieser Art täuschend ähnlich ist eine von Baker auf Borneo (Sandakan) in einem Exemplar erbeutete Art, die ich *cordicollis* sp. nov. benenne und die sich nur durch viel weitläufigere und feinere Punktierung des Kopfes, Halsschildes und der Flügeldecken unterscheidet.

4. Die Halsschildeindrücke vor dem Schildchen mässig tief, die schwielenartige Erhabenheit neben dem Nahtstreifen nur schwach erhaben, die Punktierung weniger kräftig und dicht. Länge, 3 bis 3.5 Millimeter. SIARGAO, Dapa. BUCAS, Socorro. DINAGAT. LUZON, Provinz Laguna, Mount Banahao; Mount Maquiling; Los Baños: Provinz Tayabas, Malinao: Provinz Nueva Vizcaya, Imugan. LUZON, Provinz Camarines Sur, Mount Isarog (*Baker*, *Böttcher*). **H. foveolatus** Motschulsky.[10]

Die Halsschildeindrücke vor dem Schildchen sind sehr tief und gröber und dichter punktiert, die Schwiele neben dem Nahtstreifen stark erhoben und fast kielförmig, in der Mitte der Flügeldecken mit einem schwächeren, aber immerhin deutlichen Kiel, die Oberseite der Decken gröber und dichter punktiert, ziemlich uneben. Länge, 3 bis 4 Millimeter. PALAWAN, Binaluan (*Böttcher*). Sonst in Sumatra .... **H. plicatus** Bernhauer.

5. Körper gross, langgestreckt, ohne Spur einer Punktierung. Länge, 4 bis 5 Millimeter. LUZON, Provinz Nueva Vizcaya, Imugan (*Böttcher*). Sonst in Java .... **H. parcestriatus** Fauvel.

Körper kleiner, höchstens 3 bis 5 Millimeter lang .... 6.

6. Flügeldecken neben dem Schildchen mit einigen feinen Schrägstrichen, Körper weniger Kurz, Halsschild mässig quer, ungefähr ein Viertel breiter als lang. Länge, 3.5 Millimeter.... **H. philippinus** Bernhauer.

Flügeldecken ohne feine Schrägstriche neben dem Schildchen, Körper kurz, stark konisch verengt. Länge, 2 bis 3.2 Millimeter .... 7.

7. Halsschild mässig fein oder ziemlich kräftig punktiert .... 8.

Halsschild nicht oder nur sehr fein punktiert .... 12.

8. Flügeldecken kräftig oder ziemlich kräftig punktiert .... 9.

Flügeldecken sehr fein oder undeutlich punktiert .... 10.

9. Der Eindruck vor den Hinterecken des Halsschildes tief, verhältnismässig schmal, länger als breit, aussen kielförmig begrenzt, pechschwarz, glänzend, Fühler, Taster und Beine rostfarben, Kopf kräftiger und dichter, Halsschild kräftiger, Flügeldecken feiner und weitläufiger punktiert. Ganz vom Aussehen des *insularis* Fauvel jedoch von diesem durch die deutliche Punktierung der Flügeldecken und die tiefen Eindrücke vor den Halsschildecken leicht zu unterscheiden. Länge, 3 bis 3.5 Millimeter. PALAWAN, Binaluan (*Böttcher*) .... **H. palawanensis** sp. nov.

Der Eindruck vor den Hinterecken des Halsschildes flach und breit, kaum länger als breit, aussen nur kantig begrenzt dunkel rostrot, glänzend, Kopf feiner und weitläufiger, Halsschild weniger stark, Flügeldecken viel stärker, scharf eingestochen punktiert, Flügeldecken etwas kürzer. Körper kleiner. Länge, 2.8 Millimeter (bei ausgezogenem Hinterleib). MINDORO, Subaan (*Böttcher*). Ein einzelnes Stück .... **H. boettcheri** sp. nov.

10. Flügeldecken viel länger als der Halsschild. Sehr stark glänzend kastanienbraun bis pechschwarz, Kopf und Halsschild deutlich, nicht allzu stark, Flügeldecken undeutlich punktiert. Halsschild um ein Viertel breiter als lang, von vorn nach rückwärts in leichter Rundung erweitert, hinten am breitesten, in den Hinterecken breit und flach eingedrückt, Flügeldecken um ein Drittel länger als der Halsschild, Hinterleib stark glänzend, Grundskulptur kaum sichtbar, die Schrägstriche sehr fein. Länge, 3 bis 3.2 Millimeter. LUZON, Provinz Nueva Vizcaya, Imugan: Provinz Mountain, Balbalan. (*Böttcher*) .... **H. luzonicus sp. nov.**

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[10] Ob diese Art wirklich *foveolatus* ist, kann ich mit vollster Sicherheit nicht angeben, da ich die Motschulsky'sche Art nur aus der Beschreibung kenne. Ich hielt die Art ursprünglich für eine Form des *mycetoporiformis* Motschulsky, welche jedoch keine mittleren Halsschildeindrücke besitzt.

Flügeldecken nur wenig länger als der Halsschild .... 11.

11. Halsschild in den Hinterecken mit einem ziemlich flachen breiten Eindruck, Punktierung etwas feiner, die Schrägstriche auf dem Hinterleib undeutlich, kleiner. Farbe gelb (vielleicht unreif?). Länge 2.2 Millimeter. MINDANAO, Provinz Surigao, Surigao (*Böttcher*). Ein Stück .... **H. pallidus sp. nov.**

Halsschild in den Hinterecken mit einem tiefen schmäleren Eindruck. Punktierung etwas stärker, die Schräglinien am Hinterleib schärfer eingeritzt, deutlich. Körper etwas grösser. Färbung des ausgereiften Tieres dunkel pechfarben mit helleren Beinen. Länge, 3 Millimeter. LUZON, Provinz Laguna, Los Baños (*Böttcher*). Ein Exemplar .... **H. piceolus sp. nov.**

12. Färbung rötlichgelb bis rostrot, kaum oder undeutlich punktiert. Kopf ohne Grübchen .... 13.

Färbung pechfarben, ganz von der Färbung und Gestalt des *insularis* Fauvel, jedoch durch wesentlich feinere und weitläufigere Punktierung des Halsschildes, das Vorhandensein von zwei mehr oder minder deutlichen Grübchen neben den Fühlereinlenkungsstellen, nicht oder nur sehr undeutlich punktierten Kopf, tiefere Eindrücke in den Hinterwinkeln des Halsschildes und kleinere Gestalt verschieden. Länge, 2 bis 2.3 Millimeter. MASBATE, Aroroy. SIARGAO, Dapa. LEYTE. LUZON, Provinz Laguna, Los Baños (*Böttcher*).
H. bifoveolatus sp. nov.

13. Grösser, Färbung rostrot, Halsschild und Flügeldecken bei allerschärfster Lupenvergrösserung äusserst zart, wie ein Hauch, aber immerhin wahrnehmbar punktiert, die Eindrücke in den Halsschildhinterecken beträchtlich stärker, die Fühler mässig kurz, die vorletzten Glieder kaum mehr als um die Hälfte breiter als lang. Länge, 3 Millimeter. SIARGAO, Dapa (*Böttcher*) .... **H. ferrugineus sp. nov.**

Kleiner, Färbung rötlichgelb. Halsschild spiegelglänzend, ohne wahrnehmbare Punktierung, Flügeldecken fein gerunzelt, weniger glänzend, die Halsschildeindrücke flacher, die Fühler sehr kurz, die vorletzten Fühlerglieder mehr als doppelt so breit als lang. Länge, 1.8 bis 2 Millimeter. LUZON, Provinz Camarines Sur, Mount Isarog. MINDORO, Subaan (*Böttcher*) .... **H. rufotestaceus sp. nov.**

Genus **PSEUDOLISPINODES** novum

Körper gestreckt, mässig gewölbt. Kopf viel schmäler als der Halsschild, hinten nicht abgeschnürt, mit ziemlich kleinen, flachen, kaum vorstehenden Augen. Fühler kurz, die drei ersten Glieder länger als breit, die folgenden bis zum zehnten quer, allmählich an Breite zunehmend, die vorletzten stark quer, das letzte fast eiförmig. Mandibeln kurz, dick, die eine hinter der Spitze mit einem stumpf verrundeten Zahn, hinter diesem mit einer Anzahl langer, dicht stehender Haare, die andere ohne Zahn, mit Ausnahme der Spitze lang behaart. Die Innenlade der Maxillen an der Spitze mit zwei hintereinander stehenden hakenförmigen Zähnen besetzt, hinter diesen an der abgestutzten Spitze dicht behaart, am Innenrande häutig, die Aussenlade sehr breit ähnlich wie bei *Holosus.* Auch die Kiefertaster sind denen der genannten Gattung recht ähnlich, das Endglied stark verlängert. Das Kinn ist in der Form dem der Gattung *Holosus* recht ähnlich, ebenso die Zunge sammt den Paraglossen, die zwei Zungenlappen jedoch weiter vorgestreckt, an einander stehend. Die Lippentaster sind etwas kürzer, das Endglied nur doppelt so lang als das zweite. Halsschild herzförmig, schmäler als die Flügeldecken, diese langgestreckt, am Rücken mit einer von der Schulter beginnenden, fast bis zum Hinterrande reichenden scharfen Längsfurche. Hinterleib ungerandet, an der Wurzel der vorderen Ringe abgeschnürt, Schrägstriche mehr oder minder deutlich.

Tarsen vier- oder fünfgliedrig [11] die Vorder- und Mitteltarsen in der Apikalpartie aussen mit kurzen dicken Dornen bewehrt, die Hintertarsen besitzen in der Apikalpartie eine Reihe von ungefähr neun langen, dicken, etwas gekrümmten, dicht stehenden Stacheln.

Die neue Gattung steht dem *Holosus* Motschulsky gewiss am nächsten, unterscheidet sich ausser einzelnen Details sofort durch die Bedornung der Beine. Durch dieses Merkmal sowie durch die Tarsenzahl ist sie von *Lispinodes* Sharp ebenfalls sicher zu unterscheiden.

Uebersicht der Pseudolispinodes-Arten

1. Halsschild viel schmäler als die Flügeldecken, diese sehr gross, um die Hälfte länger als der erstere, viel länger als zusammen breit. Halsschild kräftig und nicht zu weitläufig punktiert, Flügeldecken dicht chagriniert, wenig glänzend, Färbung pechschwarz mit helleren Fühlern und Beinen. Länge, 2.1 bis 2.5 Millimeter. LUZON, Provinz Mountain, Mount Polis (*Böttcher*) .... **P. longipennis sp. nov.**

Halsschild nur mässig schmäler als die Flügeldecken, diese mässig gross, höchstens um ein Drittel länger als der erstere .... 2.

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[11] Die Zählung der Tarsenglieder bei diesem Genus ist recht schwierig, da an der Stelle des ersten Gliedes die Bedornung der Schienenspitze kein klares Bild dieses Gliedes ergibt.

2. Halsschild kräftig und ziemlich dicht punktiert. Ostindien.
P. madurensis Bernhauer.
Halsschild kaum und nur weitläufig punktiert.. 3.
3. Körper grösser, breiter, glänzend, die Chagrinierung weitläufig, Halsschild nur bei stärkster Lupenvergrösserung äusserst zart punktiert. Flügeldecken kaum länger als breit, nicht punktiert. Länge, 2.2 Millimeter. LUZON, Provinz Nueva Vizcaya, Imugan (*Böttcher*). Ein einziges Stück.. **P. latiusculus** sp. nov.
Körper kleiner, schlanker, Flügeldecken um ein gutes Stück länger als der Halsschild. Eine sehr veränderliche Art. Die Färbung variiert vom dunklen pechschwarz bis zum lichten bräunlichrot oder gar bräunlichgelb. Die Gestalt ist bald sehr schlank, bald etwas robuster, die Flügeldecken sind meist nur ein Viertel, häufig jedoch fast um ein Drittel länger als der Halsschild; die Punktierung des Halsschildes ist bei der gewöhnlichen Form sehr fein, häufig jedoch stärker und deutlicher sichtbar. Bei einer Form ist diese Punktierung besonders kräftig und dichter, die Flügeldecken gut um ein Drittel länger als der Halsschild, zugleich ist der Halsschild und die Flügeldecken mehr oder minder lichter gelb (var. *puncticollis* m.). Flügeldecken in der Regel nicht oder undeutlich punktiert, bisweilen ist die Punktierung jedoch deutlich (var. *punctipennis* m.). Die Verschiedenheit der extremsten Formen ist eine solche, dass man versucht wäre spezifisch verschiedene Arten anzunehmen. Es ist mir jedoch vorläufig nicht gelungen eine Artverschiedenheit festzustellen, da alle Uebergänge vorliegen. Länge, 1.5 Millimeter. Ueber die Philippinen weit verbreitet; sonst noch von Mentawei bekannt........ **P. sinuatus** Bernhauer.

Genus THORACOPHORUS Motschulsky

1. Körper sehr klein und schmal. Länge, 1.2 bis 1.5 Millimeter................ 4.
Körper grösser und robuster, über 1.5 Millimeter lang.............................. 2.
2. Kurz, dick, Flügeldecken zusammengenommen viel breiter als lang, Hinterleib auf den vorderen Tergiten äusserst dicht, gleichmässig gerunzelt, in den Querfurchen nur sehr fein punktiert. Länge, 2 Millimeter. LUZON, Provinz Bataan, Limay. Ein Stück.
P. brevicristatus var. **deletus** Fauvel.
Gestreckter, Flügeldecken zusammengenommen nicht oder nur wenig breiter als lang, Hinterleib auf den vorderen Tergiten ausser der matten Grundskulptur mit einer Anzahl von Längsfältchen, in den basalen Querfurchen kräftig, gleichsam gekerbt punktiert................ 3.
3. Flügeldecken sehr lang, um ein gutes Stück länger als zusammen breit, um die Hälfte länger als der Halsschild, dieser an den Seiten gerade, die innere Rippe auf den Flügeldecken kaum weniger kräftig als die übrigen, die Naht bei gewisser Ansicht deutlich kielförmig; Färbung dunkel rötlichbraun mit helleren Fühlern und Beinen. Länge, 1.5 Millimeter. LUZON, Provinz Nueva Vizcaya, Imugan. CATANDUANES, Virac (*Böttcher*).. **P. longipennis** sp. nov.
Flügeldecken mässig lang, nur so lang als zusammen breit. Länge, 1.5 bis 1.7 Millimeter. LUZON, Provinz Laguna, Los Baños; Provinz

Nueva Vizcaya, Imugan (*Baker, Böttcher*). MINDORO, San Teodoro. SIARGAO, Dapa. In Anzahl gefangen................ **P. philippinus sp. nov.**[12]

4. Matt rötlichgelb. Kopf vorn mit zwei Grübchen, ohne Andeutung von Längsrippen, hinten mit zwei ocellenähnlichen Beulchen, Fühler sehr kurz, die vorletzten Glieder doppelt so breit als lang, Halsschild wenig länger als breit, an den Seiten bis zum letzten Drittel gleichbreit ohne spitzige Zähnchen, auf der Scheibe ohne Längsrippen, vorn mit einem breiten, rückwärts mit zwei rundlichen tiefen Gruben, an den Seiten rückwarts mit einem tiefen Längseindruck, wie der übrige Körper matt chagriniert. Flügeldecken viel länger als der Halsschild, länger als zusammen breit, die Innenrippe kaum, die übrigen schwach angedeutet, schwach seidig schimmernd. LUZON, Provinz Ilocos Norte, Bangui (*Böttcher*)........................**P. minutissimus sp. nov.**[13]

Genus **ESPESON** Schaufuss

1. Körper sehr klein, sehr schmal, Flügeldecken fast doppelt so lang als der Halsschild, dieser so lang als breit, an den Seiten nicht gezähnelt, beiderseits der Mittellinie mit einem langen, tiefen Längseindruck, Kopf fast breiter als der Halsschild, rundlich, grob und verhältnismässig dicht punktiert, die Augen flach, nicht vorstehend, hinter ihnen mit wohlentwickelten Schläfen, die Fühler kurz, die vorletzten Glieder stark quer, das siebente nur mässig grösser als die einschliessenden, Flügeldecken mit einer Humeralreihe kräftiger Punkte, Hinterleib chagriniert, die einzelnen Tergite neben der Mittellinie mit einem deutlichen Eindruck.. **Parespeson subg. nov.**

Rötlichgelb, sehr stark glänzend, der Hinterleib seidig glänzend. Länge, 1.2 Millimeter. LUZON, Provinz Ilocos Norte, Bangui (*Böttcher*).
E. angustissimus sp. nov.

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[12] Eine etwas veränderliche Art. Die Färbung der meisten Stücke ist bräunlichrot, es kommen jedoch auch dunklere, öfters auch ganz braunschwarze Stücke vor. Die Halsschildseiten sind bei der häufigen Form fast gerade, das Zähnchen hinter der Mitte spitzig, der Halsschild ist gewöhnlich um ein Drittel breiter als lang, die Innenrippe auf den Flügeldecken ist etwas schwächer entwickelt, so dass sie bei gewisser Ansicht nicht sichtbar ist. Es gibt jedoch Stücke, die sich durch etwas weniger kurzen, an den Seiten mehr oder minder gerundeten Halsschild, stumpfes Seitenzähnchen, stärkere Innenrippe der Decke und braunschwarze Färbung auszeichnen und zugleich etwas kräftiger und plumper gebaut sind (ab. *obscurior* m. von Butao, Mount Banahao, auf Luzon). Da jedoch einige Stücke vorhanden sind, welche Merkmale beider Formen besitzen, und eine scharfe Trennung nicht möglich ist, bin ich der Meinung, dass wir es hier nur mit immerhin bemerkenswerten Abarten einer und derselben Art zu tun haben.

[13] Die Art steht dem *Thoracophorus alluaudi* Fauvel von den Seychellen ungemein nahe und unterscheidet sich von ihr nur durch halb so geringe Grösse, schmäleren Kopf, mehr gleichbreite Seiten des Halsschildes und kaum angedeutete Innenrippe der Flügeldecken. Beide Arten zeichnen sich durch das Fehlen der Rippen auf dem Halsschild aus, weshalb für diese Arten das neue Subgenus *Leipophorus* aufgestellt sei.

Körper grösser, breiter und kürzer, Flügeldecken nur wenig oder mässig länger als der Halsschild, dieser stark quer, an den Seiten gezähnelt, Kopf kaum so breit als der Halsschild, spärlich punktiert, das siebente Fühlerglied viel breiter als die einschliessenden, die Flügeldecken überall weitläufig punktiert. Hinterleib ohne die Eindrücke zu beiden Seiten der Mittellinie (*Espeson* s. str.) .... 2.

2. Augen nicht vorstehend, flach, Schläfen deutlich hinter den Augen entwickelt, Kopf nach rückwärts deutlich erweitert, kräftig und ziemlich weitläufig punktiert. Halsschild schwach quer, um ein Viertel breiter als lang, Flügeldecken um ein Drittel länger als der Halsschild, etwas länger als zusammen breit, wie dieser kräftig und weitläufig punktiert. Färbung rostrot bis rostgelb mit meist etwas dunkleren Fühlern und helleren Beinen. Länge, 1.8 bis 2.3 Millimeter. LUZON, Provinz Laguna, Los Baños. SIARGAO, Dapa. MASBATE, Aroroy. DINAGAT. MINDANAO, Provinz Lanao, Mumungan .... **E. philippinus sp. nov.**[14]

Augen stark vorstehend, gewölbt, Schläfen fehlend, der Kopf unmittelbar hinter den Augen abgeschnürt, Halsschild stark quer, Flügeldecken nur mässig länger als der Halsschild, quadratisch .... 3.

3. Körper kleiner, schlanker, Halsschild weniger kurz und breit, fast um ein Drittel breiter als lang, um ein gutes Stück schmäler als die Flügeldecken, Punktierung ziemlich kräftig. Rostrot glänzend. Länge 1.8 bis 2 Millimeter. POLILLO (*Böttcher*) .. **E. indomalayensis sp. nov.**

Körper grösser, breiter und robuster, Halsschild kurz und breit, um die Hälfte breiter als lang, wenig schmäler als die Flügeldecken, Punktierung im allgemeinen ziemlich fein. Rostrot, glänzend. Länge, 2.2 bis 2.5 Millimeter. LUZON, Provinz Nueva Vizcaya, Imugan (*Böttcher*) .... **E. luzonicus sp. nov.**

Genus **TETRAPLEURUS** Bernhauer

1. Flügeldecken mit deutlichen Rippen .... 2.

Flügeldecken mit nur angedeuteten, sehr undeutlichen Rippen, vollkommen matt .... 4.

2. Körper stark glänzend .... 3.

Körper matt, der Hinterleib etwas glänzend, die Flügeldecken bisweilen mit schwach seidigem Schimmer. Bräunlichgelb bis rostrot, die Beine etwas heller, Kopf und Halsschild äusserst dicht gerunzelt-chagriniert, vollständig matt, der Kopf mit zwei Stirngrübchen, am Scheitel mit zwei kleinen, ocellenähnlichen Beulen. Fühler kurz, die vorletzten Glieder stark quer. Halsschild viel kürzer als bei *indicus* Bernhauer, mit ähnlichen Eindrücken, die Mittelfurche fein und durchgehend. Flügeldecken viel kürzer, jedoch immerhin fast um die Hälfte länger als der Halsschild, die Rippen breit, flach, nicht sehr scharf ausgeprägt, die ganze Oberfläche einschliesslich der Rippen äusserst fein chagriniert, nicht oder nur sehr schwach glänzend. Länge, 1.8 bis 2 Millimeter. LUZON, Provinz Laguna, Mount Maquiling (*Baker*); Los Baños, Februar, 1914; Mount Banahao: Provinz Mountain, Balbalan. MINDANAO, Provinz Surigao, Surigao (*Böttcher*) ... **T. bakeri sp. nov.**

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[14] Fünf Stücke von Dapa besitzen kürzere, den Halsschild nur den vierten Teil übertreffende Flügeldecken und kürzeren Halsschild (var. *curtus* m.), ohne das ich bisher die Ueberzeugung vom Bestande einer eigenen Art gewinnen konnte.

3. Breit, Halsschild fast um die Hälfte breiter als lang, Gestalt und Grösse des *bakeri*, durch den starken Glanz des Körpers sofort zu unterscheiden. Ausserdem von ihm durch tiefere Stirngrübchen, zwischen diesen sehr stark erhobene Stirn, tiefere, breitere Halsschildmittelfurche und das Vorhandensein von vier quergestellten glänzenden Beulen vor der Basalfurche und zwei ebensolchen am Hinterrande gegen die Hinterecken zu, durch stärker entwickelte Rippen auf den Flügeldecken und viel schwächer skulptierten Hinterleib verschieden. Länge, 1.8 Millimeter. MINDANAO, Provinz Lanao, Mumungan (*Böttcher*). Ein Stück........ **T. banghaasi sp. nov.**

Schmal, Halsschild nur um ein Viertel breiter als lang, rostrot, stark glänzend. Kopf klein, fast so lang als breit vorn mit zwei Stirngrübchen und daneben mit grossen spiegelglänzenden Fühlerhöckern, hinten kräftig und ziemlich dicht punktiert, ohne Grundskulptur. Fühler mässig kurz, die vorletzten Glieder ungefähr um die Hälfte breiter als lang. Halsschild nur wenig schmäler als die Flügeldecken, an den Seiten ziemlich gleichmässig gerundet, vor dem Hinterrande mit der normalen starken Querfurche, innerhalb der Hinter- und Vorderecken mit je einem starken Längsgrübchen, vor der Mitte des Vorderrandes mit einer kurzen tiefen Längsfurche, zu deren Seite mit je einem Punktgrübchen, hinter diesem mit einem grösseren Grübchen, von welchem einige kräftige Punkte nach rückwärts gegen die Mittellinie zu streichen, die Mitte des Seitenrandes ist in eine glänzende Beule erhoben, neben welcher sich eine grössere befindet. Flügeldecken wenig länger als der Halsschild, regelmässig quadratisch, die Rippen mässig erhoben, die Zwischenräume stark und dicht punktiert. Hinterleib chagriniert, weniger glänzend als der Vorderkörper. Länge, 2.2 Millimeter. PALAWAN, Binaluan (*Böttcher*.) Zwei Stücke........ **T. splendidus sp. nov.**

4. Rötlichgelb, kurz, Halsschild um die Hälfte breiter als lang, ganz von der Gestalt des *bakeri* m., von diesem durch die fast erloschenen, nur sehr undeutlich angedeuteten Rippen der Flügeldecken, den Mangel der feinen Mittelfurche des Halsschildes und das Vorhandensein eines deutlichen Grübchens vor den Vorderecken leicht zu unterscheiden. Länge, 2 Millimeter. LUZON, Provinz Laguna, Los Baños, Februar, 1914 (*Böttcher*). Ein einziges Stück........ **T. banosanus sp. nov.**

Schwarz, gestreckter, Halsschild um ein Drittel breiter als lang, wenig uneben, die basale Querfurche nur schwach angedeutet, die Grübchen in den Hinterecken mässig tief, sonst kaum eingedrückt, so wie der Kopf und die Flügeldecken äusserst dicht runzelig chagriniert, ohne jeden Glanz. Fühler mässig kurz, die vorletzten Glieder ungefähr um die Hälfte breiter als lang. Flügeldecken um die Häfte länger als der Halsschild, quadratisch, die Rippen äusserst schwach angedeutet. Hinterleib fein punktiert-gerunzelt, etwas glänzend. Länge, 2 Millimeter. LUZON, vom selben Fundorte (*Böttcher*). Zwei Stücke. **T. opacus sp. nov.**[15]

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[15] *Lispinodes heteroderes* Fauvel, *rugosus* Fauvel, und *seriatus* Fauvel, Rev. d'Ent. (1902) 30, 31, gehören nach der Beschreibung zweifellos nicht in die Gattung *Lispinodes* Sharp, welche dreigliedrige Tarsen besitzt, sondern in das vorstehende Genus, lassen sich aber mit keiner der philippinischen Arten identifizieren.

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THE PHILIPPINE JOURNAL OF SCIENCE

VOL. 31 NOVEMBER, 1926 No. 3

NOTES ON MEULEN'S CATALYTIC METHOD FOR THE DETERMINATION OF NITROGEN IN ORGANIC COMPOUNDS

By FREDERICK L. SMITH, 2D

Chief Chemist, Quartermaster Corps, United States Army, Manila

and

AUGUSTUS P. WEST

Professor of Chemistry, University of the Philippines

TWO TEXT FIGURES

Recently certain new preparations were made in the laboratory of the University of the Philippines and, in order to check the formulas of these compounds, we endeavored to determine the nitrogen content. We found the Dumas method to be rather unsatisfactory. We then tried Meulen's[1] method and obtained very good results. In using this method for determining nitrogen we encountered difficulties with certain compounds but, by adopting a procedure somewhat different from that described by Meulen, we succeeded in obtaining good results. That author's method appears to be an excellent one and we thought it might, perhaps, be of interest to describe in detail the procedure we used.

Meulen's method consists in heating the organic compound containing nitrogen in a current of hydrogen and passing the resulting gases over a nickel catalyst. Under these conditions the nitrogen of the organic compound is converted into ammonia, which can be determined by titration with an acid. Meulen determined the nitrogen content of various classes of ring organic compounds and found that the percentage of nitrogen determined by his method agreed very closely with the theoretical nitrogen content of those compounds.

---

[1] Recueil des travaux chimiques des pays-bas 43 (1924) 643.

Some years ago Brill and Agcaoili[2] pointed out certain additional limitations of the Kjeldahl method. According to these authors, when the nitrogen content of compounds such as pyridine, piperidine, quinoline, and isoquinoline is determined by the Kjeldahl method, the results are considerably lower than the theoretical nitrogen content of those substances. They believed that the low results were due to the formation of sulphonic acid derivatives and their resistance to decomposition. We have used Meulen's method to determine the nitrogen content of some of the compounds which appear to resist decomposition, and the results obtained were very satisfactory.

EXPERIMENTAL PROCEDURE

Our experimental procedure for Meulen's method was, in general, very similar to the procedure used by Meulen. The organic nitrogen compound was heated in a current of hydrogen. The resulting gases were passed over a nickel catalyst. The ammonia thus formed was conducted into a standard acid solution containing methyl red indicator and the excess acid determined by titration with standard alkali.

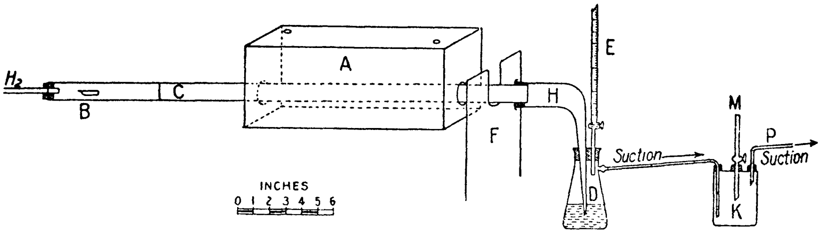

FIG. 1. Reduction apparatus.

Apparatus.—In performing our reduction experiments we used a transparent quartz combustion tube (length 67.5 centimeters) which was placed in an ordinary combustion furnace (fig. 1). The portion of the combustion tube which contained most of the catalyst was inclosed in an asbestos box *A*, which was 30.5 centimeters long, 12.7 centimeters high, and 10 centimeters wide. The bottom of the asbestos box was perforated

[2] Philip Journ. Sci. § A 12 (1917) 261.

with large holes so that the combustion tube that passed through the box could be heated readily. The substance to be analyzed was placed in the porcelain boat *B*. That part of the combustion tube outside the asbestos box and indicated by *C* contained a mixture of reduced catalyst and long-fiber asbestos inclosed between asbestos plugs. *D* is a suction flask containing distilled water acidified with standard sulphuric acid (0.05 *N*), to which were added ten drops of a 1 per cent alcoholic solution of methyl red indicator. The burette *E* contained a 0.05 *N* solution of sulphuric acid. The asbestos board *F* was placed between the asbestos box in the furnace and the suction flask *D*, in order to keep the heat of the furnace from the acid solution in the suction flask.

Hydrogen.—The hydrogen gas was prepared by treating chemically pure zinc with dilute sulphuric acid. The gas was purified by passing through a Drechsel wash bottle containing dilute potassium hydroxide solution, and through another containing fairly concentrated potassium permanganate solution, after which it was passed through four cylinders containing anhydrous, granular calcium chloride, and finally into the transparent quartz combustion tube containing the reduced catalyst and the substance to be analyzed.

Catalyst.—In preparing the catalyst we used the procedure employed by West and Gonzaga[3] in making a catalyst for the hydrogenation of Philippine oils. Before reduction, the catalyst consisted of a mixture of precipitated nickel carbonate and infusorial earth. It was prepared by dissolving 400 grams of recrystallized nickel nitrate in water and adding 90 grams of infusorial earth, after which a solution containing 180 grams of powdered sodium carbonate was added. The mixture was stirred thoroughly and filtered. The residue was washed thoroughly until free from carbonate, spread out on a porous plate, and heated in an electric oven at a temperature of 80° C. until dry, after which the dried material was powdered and kept in a glass-stoppered bottle until ready for use. Since the composition of precipitated nickel carbonate varies somewhat according to the method of preparation, and usually a portion is lost in manipulation, the exact nickel content of the catalyst was ascertained by analysis.

The catalyst was analyzed by decomposing it with hydrochloric acid, evaporating, and dehydrating the soluble silicates, after which these were eliminated by filtration. The nickel was then precipitated as hydroxide with sodium hydroxide solution in a large platinum dish, and weighed as oxide. The nickel content of the catalyst prepared for this work was approximately 23 per cent.

---

[3] Philip. Journ. Sci. 23 (1923) 279.

Before using the catalyst for the analysis of organic nitrogen compounds it was mixed with long-fiber asbestos, placed in the transparent quartz combustion tube, and reduced in a current of hydrogen. We found it advisable to place the catalyst in the tube in sections separated by asbestos plugs. In fig. 2 is given a diagram showing how the catalyst was placed in the combustion tube. The letters A_1, A_2, etc., represent asbestos plugs; the letters B_1, B_2, etc., represent a mixture of catalyst and long-fiber asbestos. The lengths of these sections of asbestos and catalyst were approximately as shown in Table 1.

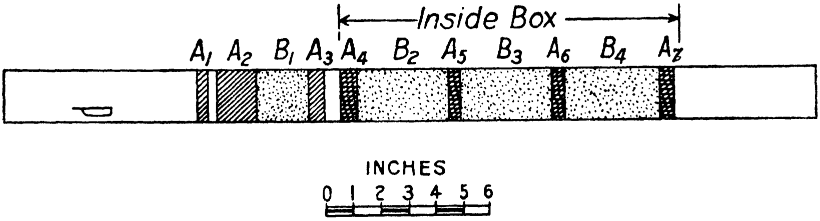

FIG. 2. Diagram showing how catalyst was placed in combustion tube.

TABLE 1.—*Lengths of sections of asbestos and catalyst.*

Section.	cm.	Section.	cm.
A_1	1.2	A_7	2.5
A_2	3.7	B_1	5.1
A_3	2.5	B_2	7.7
A_4	2.5	B_3	7.7
A_5	1.2	B_4	7.7
A_6	1.2		

After placing the catalyst in the combustion tube one end of the tube was connected to the hydrogen apparatus (fig. 1) and the other end, which passed through the asbestos box, was connected to a suction pump. Purified hydrogen gas was then passed through the tube until all the air was expelled. While the hydrogen continued to pass through the tube, that part of the combustion tube that contained no catalyst and which is indicated in the diagram by the space between *B* and *C* (fig. 1) was then gradually heated to a temperature of low redness. As the hot hydrogen gas passed through the tube the catalyst was gradually reduced. After passing the hot gas about twenty minutes the remaining portion of the tube containing the catalyst was gradually heated to a temperature of about 350° C. The reduction was continued at this temperature until no more moisture was given off from the catalyst, and the reduction completed.

Analysis.—In analyzing organic nitrogen compounds by Meulen's method the apparatus was arranged as shown in fig. 1. The porcelain boat *B* contained a weighed quantity of the substance to be analyzed. The combustion tube containing the reduced catalyst was connected to the flask *D*. A few drops of standard sulphuric acid (0.05 *N*) was dropped from the burette *E* into the distilled water in the flask *D*, so that the solution gave a distinctly acid reaction as shown by the indicator, methyl red. The empty Woulff's bottle *K* was then disconnected from the flask D, and hydrogen gas allowed to flow through the apparatus until a sample of gas withdrawn from the side tube of the flask *D* showed, when tested, that all the air was expelled from the apparatus. The Woulff's bottle *K* was again connected to the flask *D*, and the outlet *P* of the Woulff's bottle connected to a water suction pump. The tube *M* was used as a regulator and served to produce only a gentle suction. While hydrogen continued to flow through the apparatus, that part of the combustion tube containing the catalyst, both inside and outside the asbestos box, was heated to a temperature of about 350° C. The part of the tube containing the catalyst outside the asbestos box (indicated by *C*) was then covered with porcelain tiles and the temperature increased until this portion of the tube was heated to low redness. The purpose of heating this part of the tube in this manner was to make a preheater of this section. A small flame was then placed between the hydrogen inlet and the boat *B*, in order to keep the substance to be analyzed from volatilizing back of the boat near the hydrogen inlet where there was no heat to decompose any material in this part of the tube. During the reduction the acid in the burette *E* was allowed to drop at intervals into the flask *D*, so that the solution in the flask always showed a decided acid reaction. After about twenty minutes the compound usually was completely decomposed. A flame was then placed under the porcelain boat *B*, and the flow of hydrogen through the apparatus increased for a few minutes to insure complete absorption of the ammonia by the acid solution in flask *D*. The flames under the combustion tube were then extinguished and, after waiting about five minutes for the tube to cool somewhat, the top of the asbestos box was removed as were also the porcelain tiles that covered a part of the tube. After an interval of about fifteen minutes the tube had cooled sufficiently to allow removal of the flask *D* and the connecting tube *H*. The warm combustion tube was then connected to a suction pump and the flow of hydrogen continued until the tube had cooled to room temperature. The flow of hydrogen was then discontinued, the tube disconnected from the suction pump, and a stopper placed in the end of the tube. The excess acid in the suction flask *D* was then determined by titration with standard sodium hydroxide solution.

In using Meulen's method we found that certain compounds have a tendency to distill through the tube and are not decomposed completely. The nitrogen content thus determined is lower than it should be. By using the portion of the tube *C* as a preheater the compound is cracked in passing through this hot section and all the nitrogen liberated.

In working with liquids or solid compounds that have a tendency to distill through the combustion tube the various asbestos plugs we used proved advantageous in that they tended to retard the progress of the substance in passing through the tube. This seems to be especially true of the plugs A_2 and A_3, in the very hot preheater section of the tube. The passage of the volatile substance through these plugs and the mixture of catalyst and asbestos fiber placed between the plugs was retarded sufficiently for the substance to be cracked and decomposed completely. If the compound is decomposed before entering the part of the tube inclosed in the asbestos box then the nitrogen of the compound combines readily with hydrogen, in the presence of the catalyst, to form ammonia.

EXPERIMENTAL RESULTS

In Table 2 is given a list of the compounds we analyzed. The three toluides of chaulmoogric acid were analyzed by the method of Dumas and the results obtained were very unsatisfactory. When analyzed by Meulen's method these crystalline substances melted and were only partially decomposed. A portion of each of the compounds distilled through the tube, and the percentage of nitrogen obtained was considerably lower than the theoretical nitrogen content of these substances. Analysis by our modification of Meulen's method, using a part of the tube as a preheater, gave fairly good results.

TABLE 2.—*Nitrogen determined by a modification of Meulen's method.*

Compound.	Nitrogen content.	
	Found.	Theoretical.
	Per cent.	*Per cent.*
Anilide of chaulmoogric acid	3.70 3.86	3.89
Orthotoluide of chaulmoogric acid	3.67 3.77	3.79
Metatoluide of chaulmoogric acid	3.89 3.76	3.79
Paratoluide of chaulmoogric acid	3.68 3.63	3.79
Amide of chaulmoogric acid	5.08 5.01	5.02
Pyridine	17.71 17.65	17.71
Piperidine	16.52 16.47	16.45
Quinoline	10.84 10.80	10.85
Isoquinoline	10.81 10.85	10.85

The compounds pyridine, piperidine, quinoline, and isoquinoline were analyzed for nitrogen by Brill and Agcaoili, who used the Kjeldahl method, and the results obtained were low. Our modification of Meulen's method gave very satisfactory results.

In analyzing compounds like quinoline, which contain a high percentage of carbon, a considerable amount of carbon is deposited on the side of the tube and also on the catalyst when the analysis is completed. After two analyses such as this we found it advisable to clean the tube and put in a new charge of catalyst because the carbon seemed to retard the activity of the catalyst for subsequent analyses.

When the entire apparatus has been arranged and the catalyst reduced, the time required for an analysis is about one hour.

According to Meulen the substance to be analyzed should be placed in the porcelain boat and mixed with powdered metallic nickel. Our experiments indicated, however, that mixing the substance with nickel seems to be necessary only in the case of solid compounds and not with liquids.

Meulen used methyl orange as an indicator. We found that methyl red, which is a somewhat more sensitive indicator, seemed to give more accurate results.

In using Meulen's method it is preferable to use a small quantity of the sample (less than 0.1 gram) for the analysis. A larger quantity deposits too much carbon in the tube and, after a few analyses, the catalyst becomes ineffective and must be replaced by a new charge.

TABLE 3.—*Protein content of stock "feed."*

Sample No.	Material.	Protein content.	
		Modified Meulen method.	Kjeldahl method.
		Per cent.	*Per cent.*
1	Barri grass	9.32	9.15
2	do	7.02	6.74
3	Alfalfa hay	7.60	7.43
4	Rice hay	9.19	9.01
5	Wheat hay	8.20	8.11

In addition to the analysis of pure compounds we also analyzed a few natural products, such as grass and hay, in order to compare the results obtained by our modification of Meulen's method with those by the Kjeldahl method for such products. The results obtained were calculated as protein ($6.25 \times N$) on the dry basis. The rice hay and both of the grasses used were Philippine products and the alfalfa and wheat hay were American products. As shown by the data given in Table 3, our modification of Meulen's method appears to serve as an excellent check on the Kjeldahl method for natural products as well as for pure compounds.

Analysis of the barri grass sample 1 showed that it contained 1.33 per cent chlorine calculated on the dry basis. Since chlorides retard the activity of the catalyst, these natural products were analyzed for nitrogen by placing a short layer (3 centimeters) of soda lime in the combustion tube just before the preheater section, and another short layer (2 centimeters) after the section inclosed in the asbestos box. After the reduction the material remained in the porcelain boat as a charred mass. We found it advisable to clean the tube and replace the catalyst with a new charge after each analysis of substances containing halogens.

SUMMARY

A modification of Meulen's catalytic method for the determination of nitrogen in organic compounds has been described. This modification consists in separating in sections, by means of asbestos plugs, the mixture of catalyst and asbestos fiber. The essential feature of this modification is the preheater section of the combustion tube. The preheater serves to crack volatile organic compounds, so that all the nitrogen is liberated before entering the catalyst in the section of the tube inclosed in the asbestos chamber.

The exact procedure for preparing the catalyst and the arrangement of the catalyst in the combustion tube have been described, and detailed directions for the analysis of various kinds of nitrogen compounds have been given.

Toluides of chaulmoogric acid, when analyzed for nitrogen by the Dumas method, gave unsatisfactory results. With the ordinary Meulen's method these crystalline compounds melted and distilled through the catalyst with partial decomposition, giving low results. Satisfactory results were obtained with our modification of Meulen's method.

Compounds such as pyridine, piperidine, quinoline, and isoquinoline, which appear to resist decomposition when analyzed for nitrogen by the Kjeldahl method, gave satisfactory results by the modified Meulen's method.

A comparison of the modified Meulen method with the Kjeldahl method for the determination of nitrogen in natural products, such as grass and hay, indicated that the modified Meulen method may serve as an excellent check on the Kjeldahl method.

Our results indicate that the modified Meulen method is an excellent method, in that it is accurate and fairly rapid.

ILLUSTRATIONS

TEXT FIGURES

FIG. 1. Reduction apparatus.
2. Diagram showing how catalyst was placed in the combustion tube.

CONTRIBUTIONS TO THE BRYOLOGICAL FLORA OF THE PHILIPPINES, VI[1]

By V. F. BROTHERUS

Of Helsingfors, Finland

DICRANACEÆ

Genus **TREMATODON** Michx.

Trematodon acutus C. Müll.

LUZON, Batangas Province, Taal Volcano, *Bur. Sci. 27249 Ramos.*

Area: Java.

Trematodon drepanellus Besch.

LUZON, Bontoc Subprovince, Mount Polis, *Bur. Sci. 38234 Ramos and Edaño.*

Genus **WILSONIELLA** C. Müll.

Wilsoniella acutifolia Broth.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28740 Ramos and Edaño:* Ilocos Norte Province, *Bur. Sci. 33393 Ramos.*

Genus **DICRANELLA** Schimp.

Dicranella coarctata (C. Müll.) Bryol. jav.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38232 Ramos and Edaño.*

Genus **CAMPYLOPUS** Brid.

Campylopus foxworthyi Broth.

LUZON, Benguet Subprovince, Pauai, about 2,300 meters, *Bur. Sci. 32066 Santos.*

Genus **THYSANOMITRIUM** Schwaegr.

Thysanomitrium blumii (Doz. et Molk.) Broth.

LUZON, Rizal Province, Mount Susong-Dalaga, *Bur. Sci. 29447 Ramos:* Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38264*

---

[1] The geographic distribution is not indicated in the present paper for the species that were included in parts I to V.

Ramos and Edaño. MINDANAO, Bukidnon Subprovince, Mount Lipa, *Bur. Sci. 37168 Ramos and Edaño.*

Thysanomitrium subexasperatum (C. Müll.) Broth.

LUZON, Bontoc Subprovince, Mount Polis, *Bur. Sci. 38235, 38236 Ramos and Edaño;* Mount Pukis, *Bur. Sci. 38263 Ramos and Edaño.*

Genus **DICRANODONTIUM** Bryol. eur.

Dicranodontium nitidum (Doz. et Molk.) Fleisch.

MINDANAO, Bukidnon Subprovince, Mount Lipa, *Bur. Sci. 37165 Ramos and Edaño.*

Dicranodontium brachydictyon sp. nov.

Robustiusculum, cæspitosum, cæspitibus densiusculis, lutescenti-fuscescentibus, nitidiusculis. Caulis erectus, ad 8 cm altus, fusco-tomentosus, dense foliosus, dichotome ramosus vel simplex. Folia erecto-patentia vel indistincte falcatula, canaliculato-concava, e basi late lanceolata sensim longissime subulata, ad 7 mm longa, marginibus summo apice tantum serrulatis; nervo latissimo, basi bene limitato, excedente; cellulis subulæ superne quadratis, dein breviter linearibus, basilaribus internis laxe rectangularibus, hyalinis, externis angustissime linearibus, limbum pluriseriatum efformantibus, alaribus vesiculosis, fusco-aureis vel hyalinis, spatium excavatum efformantibus. Caetera ignota.

LUZON, Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38253 Ramos and Edaño.*

Species foliis cellulis supremis quadratis a congeneribus jam dignoscenda.

Genus **DICRANOLOMA** Ren.

Dicranoloma braunii (C. Müll.) Par.

LUZON, Benguet Subprovince, Pauai, *Bur. Sci. 32062 Santos.*

Dicranoloma leucophyllum (Hamp.) Par. var. **kurzii** (Limpr.).

LUZON, Benguet Subprovince, Pauai, *Bur. Sci. 32056 Santos.*

Area: Java.

Dicranoloma reflexum (C. Müll.) Ren.

LUZON, Camarines Sur Province, Mount Isarog, *Bur. Sci. 22114 Ramos.*

Area: Java, Timor, Flores.

LEUCOBRYACEÆ

Genus LEUCOBRYUM Hamp.

Leucobryum sanctum Hamp.

LUZON, Apayao Subprovince, Mount Sulu, *Bur. Sci. 28334 Fenix.* MINDANAO, Surigao Province, *Bur. Sci. 34654 Pascasio:* Zamboanga Province, Malangas, *Bur. Sci. 37470 Ramos and Edaño.*

Leucobryum scalare C. Müll. var. **tjibodensis** Fleisch.

LUZON, Bontoc Subprovince, Bauco, *Bur. Sci. 3964 Vanoverbergh.*

Leucobryum pentastichum Doz. et Molk.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35784 Martelino and Edaño:* Antique Province, *Bur. Sci. 32624 McGregor.*

Area: Java.

Leucobryum bowringii Mitt.

LUZON, Apayao Subprovince, Mount Sulu, *Bur. Sci. 28451 Fenix.*

Leucobryum sericeum Broth.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35763 Martelino and Edaño.* BUCAS GRANDE ISLAND, *Bur. Sci. 35932 Ramos and Pascasio.*

Genus CLADOPODANTHUS Doz. et Molk.

Cladopodanthus muticus sp. nov.

Robustiusculus, caespitosus, caespitibus densis, rigidis, albescentibus. Caulis adscendens, ad 3 cm altus, dense foliosus, dichotome ramosus, ramis supremis brevibus. Folia imbricata, cochleariformi concava, elongate ovato-oblonga, rotundato-obtusa vel truncata, plerumque mutica, raro apiculata, c. 3 mm longa, marginibus superne late incurvis, integerrimis; nervo latissimo, leucocystis bistratosis, chlorocystis dorso approximatis; cellulis angustissimis, limbum basi 4 seriato, superne sensim angustiore, infra apicem desinente efformantibus. Caetera ignota.

PANAY, Capiz Province, Mount Salibongbong, on old tree, *Bur. Sci. 35787 Martelino and Edaño.*

Species distinctissima, a congeneribus foliis muticis jam dignoscenda.

Genus **OCTOBLEPHARUM** Hedw.

Octoblepharum albidum (L.) Hedw.

PANAY, Antique Province, *Bur. Sci. 32624 p. p. McGregor.*

Genus **LEUCOPHANES** Brid.

Leucophanes albescens C. Müll.

LUZON, Rizal Province, Antipolo, *Bur. Sci. 29576 Ramos and Edaño.*

Leucophanes octoblepharoides Brid.

PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35819, 35822 Martelino and Edaño.*

Leucophanes candidum (Hornsch.) Lindb.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29817 Ramos and Edaño.* PANAY, Capiz Province, Libacao, *Bur. Sci. 35769, 35773, 35780 Martelino and Edaño.*

CALYMPERACEÆ

Genus **SYRRHOPODON** Schwaegr.

Syrrhopodon amoenus Broth.

LUZON, Laguna Province, Mount Maquiling, 750 meters, *Bur. Sci. 17060 Robinson.* PANAY, Capiz Province, Libacao, *Bur. Sci. 35771 Martelino and Edaño.*

Syrrhopodon revolutus Doz. et Molk.

CATANDUANES, *Bur. Sci. 30610* Ramos.

Syrrhopodon albovaginatus Schwaegr.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35768, 35770 Martelino and Edaño;* Jamindan, *Bur. Sci. 30840 Ramos and Edaño.*

Syrrhopodon mülleri (Doz. et Molk.) Lac.

CATANDUANES, *Bur. Sci. 30609 Ramos.*

Syrrhopodon croceus Mitt.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35779 p. p. Martelino and Edaño.*

Genus **THYRIDIUM** Mitt.

Thyridium constrictum (Sull.) Mitt.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28941 Ramos and Edaño.*

Genus **CALYMPERES** Sw.

Calymperes orientale Mitt.

POLILLO, *Bur. Sci. 10505 McGregor.*

Calymperes orientale Mitt. var. **polytrichoides** Fleisch.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35781 Martelino and Edaño.*

Calymperes (Hyophilina) ramosi sp. nov.

Gracilescens, caespitosum, caespitibus densiusculis, atroviridibus. Caulis erectus, vix ultra 7 mm altus, basi fusco-radiculosus, dense foliosus, simplex vel furcatus. Folia normalia sicca incurva, humida erecto-patentia, profunde canaliculato-concava e parte vaginante brevi, haud latiore, minutissime serrulata late ligulata, rotundato-obtusa; ad 2.5 mm longa, marginibus late incurvis, integerrimis; nervo valido, infra summum apicem folii evanido, dorso superne scabriusculo; cellulis laminalibus minutissimis, subrotundis, papillosis, subpellucidis, cancellinis obovatis, e cellulis breviter rectangularibus compositis, basilaribus intramarginalibus anguste linearibus, teniolam 4 seriatam, brevem, luteam efformantibus, marginalibus uniseriatis, brevibus. Folia anomala in acumen elongatum, proboscideum apice dilatatum attenuata ibidemque filamentis fusiformibus, multiseptatis, fuscis fasciculatim obsessum. Caetera ignota.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29824, 29825 Ramos and Edaño.*

POTTIACEÆ

Genus **WEISIA** Hedw.

Weisia edentula Mitt.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29826 Ramos and Edaño.*

Genus **BARBULA** Hedw.

Barbula inflexa C. Müll.

LUZON, Batangas Province, Taal Volcano, *Bur. Sci. 29250 Ramos.*

Barbula consanguinea Mitt.

LUZON, Pangasinan Province, Labrador, Mount San Isidro, *Bur. Sci. 30138 Fenix.*

Barbula (Hydrogonium) edanoi sp. nov.

Gracilis, caespitosa, caespitibus densiusculis, fuscescentibus. Caulis erectus, ad 3 cm altus, inferne fusco-radiculosus, densiuscule foliosus, simplex. Folia sicca flexuoso-incurva, humida patentia, carinato-concava, lanceolata, acutiuscula, apiculo hyalino terminata, ad 2 mm longa et ad 0.57 mm lata, marginibus inferne anguste recurvis, integerrimis; nervo sat tenui, rufescente, infra summum apicem folii evanido, dorso laevi; cellulis laminalibus quadratis, 8–10 μ, minutissime verrucosis, pellucidis, basilaribus rectangularibus, laevissimis, infimis fuscis. Caetera ignota.

LUZON, Bontoc Subprovince, Bontoc, *Bur. Sci. 38267 Ramos and Edaño.*

Species cum B. hygrophila Fleisch. comparanda, sed foliis longioribus, angustius acuminatis, pellucidis dignoscenda.

Barbula (Eubarbula) subulata sp. nov.

Gracilis, caespitosa, caespitibus laxis, fuscescenti-viridibus. Caulis erectus, ad 1 cm vel paulum ultra altus, inferne fusco-radiculosus, laxiuscule foliosus, simplex. Folia erecto-patentia, sicca erectiora, flexuosula, carinato-concava, e basi lanceolata sensim longe subulata, acuta, ad 2 mm longa, marginibus recurvis, summo apice denticulis paucis instructis; nervo validiusculo, rufescente, continuo, dorso laevi; cellulis minutissimis, quadratis, basim versus sensim majoribus, basilaribus internis rectangularibus, omnibus laevissimis. Seta c. 1.5 cm, tenuissima, rubra. Theca minuta, oblongo-cylindrica, fusca. Caetera ignota.

LUZON, Bontoc Subprovince, Bontoc, *Bur. Sci. 38268 Ramos and Edaño.*

Species B. comosae Doz. et Molk. affinis, sed foliis brevioribus, in subulam angustam, acutam attenuatis dignoscenda.

Genus TRICHOSTOMUM Hedw.

Trichostomum (Oxystegus) atrovirens sp. nov.

Gracilescens, caespitosa, caespitibus densis, late extensis, atroviridibus. Caulis erectus vel adscendens, ad 2 cm altus, inferne fusco-radiculosus, dense foliosus, plerumque ramosus. Folia erecto-patentia, sicca crispula, canaliculato-concava, e basi brevi, vaginante late lineari-lanceolata, breviter acuminata, aristatula, ad 2.5 mm vel paulum ultra longa, integerrima vel summo apice minutissime serrulata; nervo valido, superne tenuiore, plerumque breviter excedente, laevi; cellulis laminalibus

minutissimis, rotundatis et quadratis, vaginalibus elongate rectangularibus, lutescentibus, omnibus laevissimis. Bractea perichaetii altus vaginantes. Seta vix ad 1 cm alta, tenuissima, lutea. Caetera ignota.

LUZON, Rizal Province, Mount Susong-Dalaga, *Bur. Sci. 29446 Ramos and Edaño.*

Species T. cylindrico (Bruch) C. Müll. affinis, sed foliis late lineari-lanceolatis dignoscenda.

Genus **HYOPHILA** Brid.

Hyophila micholitzii Broth.

LUZON, Rizal Provice, Mount Susong-Dalaga, *Bur. Sci. 29450 Ramos and Edaño.*

FUNARIACEÆ

Genus **FUNARIA** Schreb.

Funaria calvescens Schwaegr.

LUZON, Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38265 Ramos and Edaño:* Lepanto Subprovince, Mount Data, *Bur. Sci. 40536 Ramos and Edaño:* Bulacan Province, Angat, *Bur. Sci. 34331 Ramos and Edaño.*

BRYACEÆ

Genus **WEBERA** Hedw.

Webera scabridens (Mitt.) Jaeg.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38229 Ramos and Edaño.*

Genus **BRACHYMENIUM** Schwaegr.

Brachymenium nepalense Hook.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38227 Ramos and Edaño:* Laguna Province, Mount Banahao, *Bur. Sci. 28016 Ocampo.*

Genus **BRYUM** (Dill.) Schimp.

Bryum ambiguum Dub.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29819 Ramos and Edaño;* Mount Susong-Dalaga, *Bur. Sci. 29451 Ramos and Edaño:* Tayabas Province, Umirey, *Bur. Sci. 29087 Ramos and Edaño.*

Bryum coronatum Schwaegr.

LUZON, Ilocos Norte Province, *Bur. Sci. 33391 Ramos.*

Bryum ramosum (Hook.) Mitt.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38231 Ramos and Edaño;* Masapilid, *Bur. Sci. 38246 p. p. Ramos and Edaño.*

Genus RHODOBRYUM (Schimp.) Hamp.

Rhodobryum giganteum (Hook.) Mitt.

LUZON, Bontoc Subprovince, Mount Pukis, *Bur. Sci. 37776 Ramos and Edaño.*

MNIACEÆ

Genus MNIUM (Dill.) L.

Mnium rostratum Schrad.

LUZON, Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38256 Ramos and Edaño.*

RHIZOGONIACEÆ

Genus RHIZOGONIUM Brid.

Rhizogonium spiniforme (L.) Bruch.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29818, 29823, 29826 Ramos and Edaño;* Mount Susong-Dalaga, *Bur. Sci. 29445, 29448 Ramos and Edaño:* Pangasinan Province, Labrador; Mount San Isidro, *Bur. Sci. 30139 Fenix:* Apayao Subprovince, Mount Sulu, *Bur. Sci. Fenix;* Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38257 Ramos and Edaño;* Mount Masapilid, *Bur. Sci. 38244, 38251 Ramos and Edaño.* MINDANAO, Bukidnon Subprovince, Mount Candoon, *Bur. Sci. 37183, 37188 Ramos and Edaño.*

HYPNODENDRACEÆ

Genus MNIODENDRON Lindb.

Mniodendron divaricatum (Reinw. et Hornsch.) Lindb.

LUZON, Bontoc Subprovince, Mount Masapilid, *Bur. Sci. 38245 Ramos and Edaño:* Laguna Province, Muont Banahao, *Bur. Sci. 28157 Ocampo.* PANAY, Antique Province, *Bur. Sci. 32630, 32651 McGregor:* Capiz Province, Mount Bulilao, *Bur. Sci. 35817 Martelino and Edaño.* MINDANAO, Bukidnon Subprovince, Mount Lipa, *Bur. Sci. 37164 Ramos and Edaño.*

Mniodendron korthalsii Bryol. jav.

LUZON, Kalinga Subprovince, Lubuagan; Mount Masingit, *Bur. Sci. 37520, 37535 Ramos and Edaño.*

BARTRAMIACEÆ

Genus **PHILONOTIS** Brid.

Philonotis revoluta Bryol. jav.

LUZON, Bontoc Subprovince, Bauco, *Bur. Sci. 3965 Vanoverbergh.*

Philonotis tjibodensis Fleisch.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28939 Ramos and Edaño.*

Genus **FLEISCHEROBRYUM** Loesk.

Fleischerobryum macrophyllum sp. nov.

Philonotis macrophylla Broth. in sched.

Robustum, caespitosum, caespitibus laxiusculis, e lutescente fuscescenti-viridibus, nitidiusculis. Caulis erectus, ad 6 cm altus, fusco-tomentosus, laxiuscule foliosus, vage ramosus vel apice ramis pluribus fastigiatis, ad 3 cm longis instructus. Folia erecto-patentia, carinato-concava, e basi ovali vel ovata sensim lanceolata, longe aristata, ad 5 mm longa et ad 1 mm lata, marginibus suberectis, superne minute serrulatis; nervo tenui, in aristam elongatam, minute serrulatam producto; cellulis superioribus anguste linearibus, apice papillose exstante, dein sensim latioribus, basilaribus laxis, tenereis, oblongo-hexagonis, laevissimis. Seta c. 5 cm vel paulum longiore, flexuosa, rubra. Theca immatura pendula, breviter oblonga, c. 5 mm longa. Planta mascula ignota.

LUZON, Bontoc Subprovince, Mount Polis, *Bur. Sci. 38289 Ramos and Edaño.*

Species pulcherrima a F. longicolli (Hamp.) Loesk. statura robustiore, foliis nervo in aristam elongatam excedente, cellulis longioribus, infimis laevissimis dignoscenda.

SPIRIDENTACEÆ

Genus **SPIRIDENS** Nees

Spiridens reinwardtii Nees.

LUZON, Bontoc Subprovince, Mount Masapilid, *Bur. Sci. 38242 Ramos and Edaño:* Apayao Subprovince, Mount Sulu, *Bur. Sci.*

28454 Fenix. PANAY, Antique Province, *Bur. Sci. 32621, 32654 McGregor.* MINDANAO, Davao Province, *Bur. Sci. Copeland "A."*

Spiridens longifolius Lindb.

LUZON, Kalinga Subprovince, Lubuagan, Mount Masingit, *Bur. Sci. 37521 Ramos and Edaño.*

ORTHOTRICHACEÆ

Genus **MACROMITRIUM** Brid.

Macromitrium rothostichum Nees.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38225, 38228 Ramos and Edaño.*

Macromitrium reinwardtii Schwaegr.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38224 Ramos and Edaño.* PANAY, Antique Province, *Bur. Sci. 32633 McGregor.*

Macromitrium salakanum C. Müll.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29822 Ramos and Edaño;* Mount Susong-Dalaga, *Bur. Sci. 29452 Ramos and Edaño.*

Macromitrium subuligerum Bryol. jav.

LUZON, Pangasinan Province, Labrador, Mount San Isidro, *Bur. Sci. 30137 Fenix;* Tayabas Province, Umirey, *Bur. Sci. 29085 Ramos and Edaño.*

Macromitrium semipellucidum Doz. et Molk.

LUZON, Camarines Province, *Bur. Sci. 27416 Alambra.* PANAY, Capiz Province, Libacao, *Bur. Sci. 35782 Martelino and Edaño.*

Macromitrium assimile Broth.

MINDANAO, Bukidnon Subprovince, Mount Candoon, *Bur. Sci. 37181 Ramos and Edaño.*

Macromitrium merrillii Broth.

ALABAT ISLAND, *Bur. Sci. 10559 Merrill.*

Macromitrium sulcatum (Hook. et Grev.) Brid.

MINDANAO, Bukidnon Subprovince, Mount Candoon, *Bur. Sci. 37184, 37185 Ramos and Edaño.*

RHACOPILACEÆ

Genus **RHACOPILUM** Palis.

Rhacopilum spectabile Reinw. et Hornsch.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38230 Ramos and Edaño;* Mount Masapilid, *Bur. Sci. 38252 Ramos and Edaño:* Kalinga Subprovince, Lubuagan, Mount Masingit, *Bur. Sci. 37519 Ramos and Edaño:* Lepanto Subprovince, Mount Data, *Bur. Sci. 40533 Ramos and Edaño.* PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35805 Martelino and Edaño:* Antique Province, *Bur. Sci. 32648 McGregor.* MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37176 Ramos and Edaño;* Mount Candoon, *Bur. Sci. 37187 Ramos and Edaño.*

CRYPHAEACEÆ

Genus **PILOTRICHOPSIS** Besch.

Pilotrichopsis dentata (Mitt.) Besch.

PANAY, Antique Province, *Bur. Sci. 32618, 32625 McGregor.*

MYURIACEÆ

Genus **MYURIUM**

Myurium foxworthyi.

LUZON, Laguna Province, Mount Banahao, *Bur. Sci. 28013 Ocampo.* PANAY, Antique Province, *Bur. Sci. 32636 McGregor.*

PTEROBRYACEÆ

Genus **PTEROBRYELLA**

Pterobryella longifrons (C. Müll.) C. Müll.

LUZON, Bontoc Subprovince, Mount Cagua, *Bur. Sci. 38028 Ramos and Edaño:* Benguet Subprovince, Mount Puloglogo, *Bur. Sci. 40554 Ramos and Edaño.*

Genus **GAROVAGLIA** Endl.

Garovaglia punctidens Williams.

LUZON, Bontoc Subprovince, Bauco, *Bur. Sci. 3952 Vanoverbergh.*

Genus **ENDOTRICHELLA** C. Müll.

Endotrichella elegans (Doz. et Molk.) Fleisch.

PANAY, Antique Province, *Bur. Sci. 32632 McGregor:* Capiz Province, Mount Bulilao, on tree at summit, *Bur. Sci. 35809 Martelino and Edaño.*

Genus **TRACHYLOMA** Brid.

Trachyloma papillosum sp. nov.

Robustiusculum, sordide viride, opacum. Caules secundarii ad 9 cm alti, inferne simplices, foliis minutis, remotis, squamaeformibus, dein pinnatim ramosi, dense et complanate foliosi, apice propagulis axillaribus, filiformibus, fuscis instructi, ramis patentibus, simplicibus vel longioribus, pinnatim ramulosis. Folia caulina patentia, late ovato-lanceolata, breviter acuminata, acuta, c. 2.5 mm longa, marginibus e medio ad apicem serratis; nervo simplici, tenui, ad medium folii evanido; cellulis laminalibus angustis, papillis crassis, singulis vel binis instructis, basilaribus brevioribus et laxioribus. Folia ramea minora, brevius acuminata, argutius serrata. Caetera ignota.

MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37174 Ramos and Edaño.*

Species habitu T. indico Mitt. simillima, sed foliis papillosis a congeneribus adhuc cognitis dignoscenda.

TRACHYPODACEÆ

Genus **TRACHYPUS** Reinw. et Hornsch.

Trachypus hispidus C. Müll.

LUZON, Benguet Subprovince, Mount Pauai, about 2,200 meters, *Bur. Sci. 32055 Santos.*

METEORIACEÆ

Genus **FLORIBUNDARIA** C. Müll.

Floribundaria floribunda (Doz. et Molk.) Fleisch.

PANAY, Antique Province, *Bur. Sci. 32619 McGregor.* LUZON, Bontoc Subprovince, Mount Masapilid, *Bur. Sci. 38250 Ramos and Edaño:* Benguet Subprovince, Pakdal Hill, 1,500 meters, *Bur. Sci. 9742 ex p. Merrill.*

Genus **PAPILLARIA** (C. Müll.) C. Müll.

Papillaria fuscescens (Hook.) Jaeg.

LUZON, Bontoc Subprovince, Mount Polis, *Bur. Sci. 38236 p. p. Ramos and Edaño.*

Genus **AËROBRYOPSIS** Fleisch.

Aërobryopsis lanosa (Mitt.) Broth.

PANAY, Antique Province, *Bur. Sci. 32634, 32649, 32650 McGregor.*

Genus **METEORIUM** (Doz. et Molk.) Fleisch.

Meteorium miquelianum (C. Müll.) Fleisch.

PANAY, Antique Province, *Bur. Sci. 34647 McGregor.*

Genus **METEORIOPSIS** Fleisch.

Meteoriopsis reclinata (C. Müll.) Fleisch.

LUZON, Bontoc Subprovince, Mount Masapilid, *Bur. Sci. 38248 Ramos and Edaño.*

NECKERACEÆ

Genus **CALYPTOTHECIUM** Mitt.

Calyptothecium tumidum (Mitt.) Fleisch.

LUZON, Benguet Subprovince, Mankayan to Baguio, *Bur. Sci. 40534 p. p. Ramos and Edaño.*

Genus **NECKEROPSIS** Reichdt.

Neckeropsis lepineana (Mont.) Fleisch.

PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35824 Martelino and Edaño:* Antique Province, about 800 meters, *Bur. Sci. 32620, 32623 McGregor.*

Genus **HIMANTHOCLADIUM** (Mitt.) Fleisch.

Himanthocladium loriforme (Bryol. jav.) Fleisch.

LUZON, Apayao Subprovince, *Bur. Sci. 28336 Fenix:* Pangasinan Province, Labrador, Mount San Isidro, *Bur. Sci. 30141 Fenix.*

Genus **HOMALIODENDRON** Fleisch.

Homaliodendron flabellatum (Dicks.) Fleisch.

MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37171 Ramos and Edaño.*

HOOKERIACEÆ

Genus **DISTICHOPHYLLUM** Doz. et Molk.

Distichophyllum subnigricaule sp. nov.

Dioicum; gracilescens, caespitosum, caespitibus laxis, depressis, pallide viridibus, opacis. Caulis procumbens, per totam longitudinem hic illic fusco-radiculosus, dense et complanate foliosus, cum foliis c. 2.5 mm latus, dichotome ramosus. Folia sicca haud contracta, faciliter emollita, lateralia patentia, e basi spathulata late ovalia, rotundato-obtusa, mutica vel apiculo terminata, ad 1.5 mm longa et a 0.8 mm lata, integerrima; nervo

tenuissimo, ad vel ultra medium folii evanido; cellulis laminalibus teneris, rotundato-hexagonis, internis 25–35 μ, externis in pluriebus seriebus minoribus, basilaribus oblongo-hexagonis, marginalibus angustissimis, limbum biseriatum, hyalinum efformantibus. Folia dorsalia et ventralia erectiora, minora brevius spathulata. Caetera ignota.

MINDANAO, Zamboanga Province, *Bur. Sci. 8324 Merrill.*

Species D. nigricauli Mitt. affinis, sed foliis laxius areolatis dignoscenda.

Genus **CALLICOSTELLA** (C. Müll.) Mitt.

Callicostella papillata (Mont.) Mitt.

LUZON, Rizal Province, Mount Lumilan, *Bur. Sci. 29827 Ramos and Edaño;* Mount Lumutan, *Bur. Sci. 29820 Ramos and Edaño;* Tayabas Province, Mount Binuang, *Bur. Sci. 28937 p. p. Ramos and Edaño.* PANAY, Capiz Province, Jamindan, *Bur. Sci. 30968, 31090, 31226 Ramos and Edaño.*

Callicostella beccariana (Hamp.) Jaeg.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28934 Ramos and Edaño.*

Genus **CYCLODICTYON** Mitt.

Cyclodictyon blumeanum (C. Müll.) Broth.

MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37175 p. p., 3718 Ramos and Edaño.*

Genus **CHAETOMITRIUM** Doz. et Molk.

Chaetomitrium orthorrhynchum Doz. et Molk.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28938 p. p. Ramos and Edaño.*

Chaetomitrium elmeri Broth.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35778 Martelino and Edaño.*

Chaetomitrium perarmatum sp. nov.

Gracilescens, rigidum, ramulos involvens laete viride, nitidiusculum. Caulis elongatus, repens, densissime ramosus, ramis patulis, strictis, vix ultra 1 cm longis, teretibus, simplicibus, obtusis. Folia ramea laxe imbricata, breviter oblongo-ligulata, rotundato-obtusa vel breviter ovato-oblonga, apiculata, ad 0.8 mm longa, dorso superne setulis crassis ornata, marginibus superne argute serratis; nervis binis tenuissimis, vix ad medium folii productis, cellulis anguste linearibus, apicalibus in foliis obtusis minutis, rotundatis. Bracteae perichaetii internae erectae, in acumen subulatum, argute serratum sensim attenuatae. Seta c. 1 cm alta, tenuis, setulis dense vestita, basi tantum laevis. Theca suberecta, obovata. Operculum longe subulatum. Calyptra mitraeformis, superne ciliis brevibus, patulis obtecta, basi fimbriata, fimbriis ex unica seria cellularum constructis.

LUZON, Apayao Subprovince, *Bur. Sci. 28335 Fenix.*

Species praecedenti similis, sed foliis dorso superne setulis ornata jam dignoscenda.

Genus **CHAETOMITRIOPSIS** Fleisch.

Chaetomitriopsis glaucocarpa (Reinw.) Fleisch.

LUZON, Kalinga Subprovince, Lubuagan, Mount Masingit, *Bur. Sci. 38217 Ramos and Edaño:* Benguet Subprovince, Pakdal Hill, 1,500 meters, *Bur. Sci. 9742 p. p. Merrill.*

SYMPHYODONTACEÆ

Genus **SYMPHYODON** Mont.

Symphyodon copelandii sp. nov.

Gracilis, caespitosus, caespitibus laxiusculis, lutescentibus, nitidis. Caules secundarii pendentes, steriles ad 5 cm longi, laxiuscule foliosi, pinnatim ramosi, fertiles breviores, bipinnatim ramosi. Folia caulina longe decurrentia, erecto-patentia, sicca laxe adpressa, concava, ovato-lanceolata, breviter acuminata, obtusiuscula vel acuta, ad 0.57 mm longa, marginibus erectis, superne serrulatis; nervis binis, tenuibus, infra medium folii evanidis; cellulus angustissime linearibus, apice papillosa exstante, basilaribus infimis abbreviatis, alaribus paucis minutis, quadratis. Folia ramea minora, densiora, argute serrata. Bracteae perichaetii internae e basi vaginante sensim lanceolato-subulatæ, integrae. Seta c. 1.5 cm alta, tenuis, rubra, superne scabro. Theca erecta, oblonga, dense spiculosa, fusca. Caetera ignota.

LUZON, Benguet Province, Pauai, *E. B. Copeland 1337.*

HYPOPTERYGIACEÆ

Genus **HYPOPTERYGIUM** Brid.

Hypopterygium ceylanicum Mitt.

LUZON, Bontoc Subprovince, Bauco, *Bur. Sci. 3953 Vanoverbergh.*

THUIDIACEÆ

Genus PELEKIUM Mitt.

Pelekium velatum Mitt.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28936 Ramos and Edaño.* PANAY, Capiz Province, Mount Salibongbong, *Bur. Sci. 35788 Martelino and Edaño;* Mount Bulilao, *Bur. Sci. 35807 Martelino and Edaño.*

Genus THUIDIUM Bryol. eur.

Thuidium meyenianum (Hamp.) Bryol. jav.

LUZON, Bontoc Subprovince, Mount Masapilid, *Bur. Sci. 38247 Ramos and Edaño.*

Thuidium investe (Mitt.) Jaeg.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29821 Ramos and Edaño.*

Area: Barma.

Thuidium tamariscellum (C. Müll.) Bryol. jav.

LUZON, Benguet Subprovince, *12939 Fenix,* Trinidad, *Bur. Sci. 14133 Robinson.*

Thuidium cymbifolium (Doz. et Molk.) Bryol. jav.

LUZON, Kalinga Subprovince, Lubuagan, Mount Masingit, *Bur. Sci. 38220 Ramos and Edaño.*

Thuidium glaucinoides Broth.

MINDANAO, Bukidnon Subprovince, Mount Candoon, *Bur. Sci. 37189 Ramos and Edaño.*

BRACHYTHECIACEÆ

Genus PLEUROPUS Griff.

Pleuropus luzonensis Broth.

LUZON, Benguet Subprovince, Mankayan to Baguio, *Bur. Sci. 40534 p. p. Ramos and Edaño.*

Genus RHYNCHOSTEGIELLA (Bryol. eur.) Limpr.

Rhynchostegiella mindorensis (Broth.) Broth.

LUZON, Tayabas Province. Umirey, *Bur. Sci. 29086 Ramos and Edaño.*

Rhynchostegiella edanoi sp. nov.

Antoicum; gracilis, caespitosa, caespitibus densiusculis, mollibus, lutescenti-viridibus, nitidiusculis. Caulis elongatus, repens, per totam longitudinem hic illic fusco-radiculosus, pinnatim ramosus, ramis patulis, vix ultra 1 cm longis, plumose foliosis, simplicibus, obtusis. Folia horride patula, sicca contracta, ovato-lanceolata, in acumen subulatum sensim attenuata, ad 1.5 mm longa et c. 0.4 mm lata, marginibus erectis, ubique serrulatis; nervo tenui, ad medium folii evanido; cellulis anguste linearibus. Bracteae perichaetii internae vaginantes, raptim in acumen recurvum, elongate subulatum, minute serrulatum attenuatae. Seta 1.5–2 cm, tenuissima, ubique scabra, rubra. Theca horizontalis, anguste oblonga, sicca deoperculata sub ore contracta. Operculum longe subulatum.

LUZON, Kalinga Subprovince, Lubuagan, Mount Masingit, *Bur. Sci. 38218, 38221 Ramos and Edaño:* Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38254, 38258 Ramos and Edaño.*

ENTODONTACEÆ

Genus **ERYTHRODONTIUM** Hamp.

Erythrodontium julaceum (Hook.) Par.

LUZON, Bontoc Subprovince, Mount Masapilid, *Bur. Sci. 38240 Ramos and Edaño.*

Genus **ENTODON** C. Müll.

Entodon longidens Broth.

LUZON, Bontoc Subprovince, Mount Masapilid, *Bur. Sci. 38248 p. p. Ramos and Edaño.*

Genus **CAMPYLODONTIUM** Doz. et Molk.

Campylodontium flavescens (Hook.) Bryol. jav.

MINDANAO, Bukidnon Subprovince, *Bur. Sci. 1506 Weber.*

Genus **TRACHYPHYLLUM** Gepp.

Trachyphyllum inflexum (Harv.) Gepp.

LUZON, Rizal Province, Mount Susong-Dalaga, *Bur. Sci. 29443 Ramos and Edaño.*

PLAGIOTHECIACEÆ

Genus STEREOPHYLLUM Mitt.

Stereophyllum (Moneurium) philippinense sp. nov.

Pseudoplagiotheciopsis philippinensis Broth. in sched.

Antoicum; gracilescens, caespitosum, caespitibus densiusculis, pallide viridibus, nitidis. Caulis breviusculus, repens, per totam longitudinem fusco-radiculosus, dense et complanate foliosus, cum foliis c. 3 mm latus, vage ramosus, ramis brevibus, obtusis. Folia lateralia patula, asymmetrica, arcuatula, oblongo-ligulata, breviter lanceolato-acuminata, acuta, ad 1.9 mm longa et ad 0.57 mm lata, apice minutissime serrulata; nervo tenui, ad medium folii evanido; cellulis laminalibus anguste linearibus, basilaribus numerosis quadratis, omnibus laevissimis. Folia dorsalia minora, erecto-patentia, symmetrica. Bracteae perichaetii internae e basi vaginante in acumen elongatum lineari-lanceolatum, minute serrulatum attenuatae. Seta vix ad 1 cm alta, tenuissima, rubra. Theca erecta, subregularis, anguste cylindrica. Operculum e basi conica breviter et obtuse rostratum.

LUZON, Rizal Province, Antipolo, *Bur. Sci. 29577 Ramos and Edaño.*

Species S. wightii (Mitt.) Jaeg. affinis, sed statura minore foliisque angustioribus dignoscenda.

SEMATOPHYLLACEÆ

Genus ACANTHOCLADIUM Mitt.

Acanthocladium (Tanythrix) benguetense sp. nov.

Gracilescens, caespitosum, caespitibus densis, fuscescentibus, nitidiusculis. Caulis elongatus, repens, hic illic fusco-radiculosus, dense foliosus, pinnatim ramosus, ramis patentibus, brevibus, arcuatulis vel longioribus, pinnatim ramulosis. Folia caulina erecto-patentia, sicca erectiora, concava, ovalia, sensim in acumen lanceolatum vel lanceolato-subulatum attenuata, ad 1.5 mm longis, marginibus erectis integris vel summo apice minutissime serrulatis; enervia; cellulis angustissime linearibus, apice papillose exstantibus basilaribus incrassatis, infimis fusco-aureis, alaribus magnis, oblongis, vesiculosis, hyalinis vel fuscoaureis. Folia ramea minora, lanceolata. Bracteae perichaetii internae e basi vaginante raptim in acumen elongatum, loriforme, minute serrulatum attenuatae. Seta ad 2.5 cm alta, tenuis, rubra. Theca subhorizontalis, oblonga, gibbosula, sicca deoperculata sub ore vix contracta. Operculum ignotum.

LUZON, Benguet Subprovince, Pauai, *Bur. Sci. 32065 Martelino and Edaño.*

Species A. hornschuchii (Doz. et Molk.) affinis, sed foliorum forma jam dignoscenda.

Genus TRISMEGISTIA (C. Müll.) Broth.

Trismegistia rigida (Hornsch. et Reinw.) Broth.

LUZON, Apayao Subprovince, Mount Sulu, *Bur. Sci. 28453 Fenix:* Laguna Province, Mount Banahao, *Bur. Sci. 28017 Ocampo.*

Trismegistia lancifolia (Harv.) Broth.

MINDANAO, Bukidnon Subprovince, Mount Candoon, *Bur. Sci. 37182 Ramos and Edaño.*

Trismegistia lancifolia (Harv.) Broth. var. **korthalsii** (Doz. et Molk.) Fleisch.

CATANDUANES, *Bur. Sci. 30612 Ramos.*

Trismegistia prionodontella (Broth.) Broth.

MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37177 Ramos and Edaño.*

Trismegistia densiretis sp. nov.

Gracilescens, caespitosa, caespitibus densis, lutescenti-fuscescentibus, nitidiusculis. Caules secundarii ad 3 cm vel paulum ultra longi, dense foliosi, pinnatim ramosi, pungentes ramis vix ad 1 cm longis, simplicibus. Folia caulina erecto-patentia, late ovato-lanceolata, raptim elongate subulata, ad 2.5 mm vel paulum ultra longa et ad 0.75 mm lata, marginibus erectis, superne minute serrulata; enervia; cellulis laminalibus angustissime linealibus, marginalibus tantum incrassatis, limbum pauciseriatum, indistinctum efformantibus, alaribus magnis, vesiculosis, externis divisis, fusco-aureis, spatium excavatum efformantibus. Folia ramea minora, ovato-lanceolata, superne argute serrata. Caetera ignota.

LUZON, Apayao Subprovince, Mount Sulu, *Bur. Sci. 28453 Fenix.*

Species distinctissima, foliis cellulis ubique anguste linearibus a congeneribus jam dignoscenda.

Genus MEIOTHECIUM Mitt.

Meiothecium obtusum Broth.

PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35815 Martelino and Edaño.*

Meiothecium attenuatum Broth.

PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35812 Martelino and Edaño.*

Genus WARBURGIELLA C. Müll.

Warburgiella cupressinoides C. Müll.

PANAY, Antique Province, *Bur. Sci. 32644 McGregor.* LUZON, Benguet Subprovince, Pauai, *Bur. Sci. 32065* Santos.

Genus TRICHOSTELEUM (Mitt.) Jaeg.

Trichosteleum hamatum (Doz. et Molk.) Jaeg.

PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35793 Martelino and Edaño*; Jamindan, *Bur. Sci. 31394 Ramos and Edaño.*

Trichosteleum hamatum (Doz. et Molk.) Jaeg. var. **semimamillosum** (C. Müll.) Par.

LUZON, Rizal Province, Mount Susong-Dalaga, *Bur. Sci. 29449 Ramos and Edaño.* PANAY, Capiz Province, Libacao, *Bur. Sci. 35762, 35764, 35775, 35785, 35786 Martelino and Edaño;* Mount Bulilao, *Bur. Sci. 35796, 35802, 35811, 35814, 35816, 35818, 35821 Martelino and Edaño;* Jamindan, *Bur. Sci. 31027 Ramos and Edaño.* MINDANAO, Bukidnon Subprovince, Mount Candoon, *Bur. Sci. 37169* (seta sublaevi), *37186 Ramos and Edaño.*

Trichosteleum boschii (Doz. et Molk.) Jaeg.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35767, 35772 Martelino and Edaño;* Mount Bulilao, *Bur. Sci. 35777 Martelino and Edaño.*

Genus RHAPHIDOSTICHUM Fleisch.

Rhaphidostichum piliferum (Broth.) Broth.

PANAY, Antique Province, mossy forest about 1,000 meters, *Bur. Sci. 32631 McGregor.*

Genus ACROPORIUM Mitt.

Acroporium subulatum (Hamp.).

PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35793 p. p., 35800 Martelino and Edaño.*

Acroporium sigmatodontium (C. Müll.) Fleisch.

LUZON, Bontoc Subprovince, Bauco, *Bur. Sci. 3967 Vanoverbergh.* PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35794, 35798, 35799, 35801, 35803, 35813 Martelino and Edaño.*

Genus **TAXITHELIUM** Spruc.

Taxithelium instratum (Brid.) Broth.

LUZON, Rizal Province, Mount Susong-Dalaga, *Bur. Sci. 29444 Ramos and Edaño:* Tayabas Province, Mount Binuang, *Bur. Sci. 28935 p. p. Ramos and Edaño.* PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35806, 35808, 35810, 35820 Martelino and Edaño;* Jamindan, *Bur. Sci. Ramos and Edaño.*

Taxithelium nepalense (Schwaegr.) Broth.

LUZON, Rizal Province, Antipolo, *Bur. Sci. 29578, 29579 Ramos and Edaño.* PANAY, Capiz Province, Libacao, *Bur. Sci. 35774 Martelino and Edaño.*

Taxithelium percapillipes Broth.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28938 Ramos and Edaño.*

Taxithelium (Polystigma aptera) argentatum sp. nov.

Antoicum; robustiusculum, caespitosum, caespitibus laxiusculis, depressis, albescentibus, vel pallide lutescentibus, sericeonitidis. Caulis elongatus, repens, per totam longitudinem fusco-radiculosus, dense et complanate foliosus, pinnatim ramosus, ramis patulis, 5–7 mm longis, valde complanatis, simplicibus, obtusis. Folia caulina erecto-patentia, concaviuscula, ovato-lanceolata, in acumen breviter subulatum attenuata, ad 1.7 mm longa et ad 0.6 mm lata, marginibus erectis, integris vel apice indistincte serrulatis; enervia; cellulis angustissime linearibus, laevissimis, alaribus haud diversis. Folia ramea eisdem caulinis similia, sed brevius acuminata. Bracteae perichaetii internae erectae vel falcatulae, e basi vaginante sensim lanceolato-subulatae, integrae vel apice minutissima serrulatae. Seta 2.5–3 cm alta, tenuissima, rubra. Theca horizontalis, obovata, fuscidula.

LUZON, Apayao Subprovince, *Bur. Sci. 28334 p. p. Fenix.* PANAY, Capiz Province, Jamindan, *Bur. Sci. 30839 Ramos and Edaño.*

Species T. capillipedi (Bryol. jav.) Broth. affinis, sed statura robustiore foliorumque forma dignoscenda.

Taxithelium robinsonii Broth.

MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37178 Ramos and Edaño.*

Genus **GLOSSADELPHUS** Fleisch.

Glossadelphus (Anastigma) bakeri sp. nov.

Taxithelium divergens Broth. in sched.

Gracilis, caespitosus, caespitibus densiusculis, depressis, saturate viridibus, opacis. Caulis elongatus, repens, per totam longitudinem fusco-radiculosus, laxiuscule foliosus, densiuscule pinnatim ramosus, ramis vix ultra 5 mm longis, dense et complanate foliosis, simplicibus, obtusis. Folia caulina patentia, concava, ovato-lanceolata, in subulam attenuata, ad 1 mm vel paulum ultra longa, marginibus ob cellulas exstantes subserrulatis; enervia; cellulis breviter linearibus, papilla magna, apicali instructis. Folia ramea eisdem caulinis similia, sed brevius acuminata, distinctius serrulata. Caetera ignota.

LUZON, Laguna Province, Mount Maquiling near Los Baños, *Baker 2588.*

Species a congeneribus foliorum forma prima fronte dignoscenda.

HYPNACEÆ

Genus **ECTROPOTHECIUM** Mitt.

Ectropothecium monumentorum (Dub.) Jaeg.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35783 Martelino and Edaño.*

Ectropothecium luzoniae (C. Müll.) Broth.

LUZON, Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38266 Ramos and Edaño.* PANAY, Antique Province, *Bur. Sci. 32640. 32655 McGregor.*

Ectropothecium ferrugineum (C. Müll.) Jaeg.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28937 Ramos and Edaño.* PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35795, 35797 Martelino and Edaño.* MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37172 Ramos and Edaño.*

Ectropothecium subintorquatum Broth.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28935 Ramos and Edaño.* MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37179 Ramos and Edaño.*

Ectropothecium falciforme (Doz. et Molk.).

MINDANAO, Bukidnon Subprovince, Tangkulan and vicinity, *Bur. Sci. 37173 Ramos and Edaño.*

Ectropothecium brachyphyllum Broth.

PANAY, Antique Province, *Bur. Sci. 32641, 32645 McGregor.*

Ectropothecium cyperoides (Hook.) Jaeg.

PANAY, Capiz Province, Libacao, *Bur. Sci. 35766 Martelino and Edaño.*

Genus **TRACHYTHECIUM** Fleisch.

Trachythecium verrucosum (Hamp.) Fleisch.

PANAY, Capiz Province, Mount Bulilao, *Bur. Sci. 35807 Martelino and Edaño.*

Genus **VESICULARIA** (C. Müll.) C. Müll.

Vesicularia meyeniana (Hamp.) Broth.

LUZON, Tayabas Province, Mount Binuang, *Bur. Sci. 28936 p. p. Ramos and Edaño.* PANAY, Capiz Province, Mount Salibongbong, *Bur. Sci. 35789, 35792 Martelino and Edaño;* Jamindan, *Bur. Sci. 31074 Ramos and Edaño.*

RHYTIDIACEÆ

Genus **GOLLANIA** Broth.

Gollania benguetensis sp. nov.

Gracilescens, caespitosa, caespitibus densis, late extensis, mollibus, lutescenti-viridibus, nitidis. Caulis procumbens, dense et complanate foliosus, plus minusve distincte pinnatim ramosus, ramis brevibus, simplicibus vel longioribus, pinnatim ramulosis. Folia falcata, concava, ovalia, raptim in acumen lanceolato-subulatum attenuata, ad 1.9 mm longa, marginibus erectis, acumine serrulatis; nervis binis, tenuibus, longiusculis; cellulis angustissime linearibus, apice exstante, alaribus paucis, minutis, incrassatis. Caetera ignota.

LUZON, Benguet Subprovince, Mankayan to Baguio, on decayed trunks, *Bur. Sci. 40534 p. p. Ramos and Edaño.*

Species foliis falcatis oculo nudo jam dignoscenda.

DIPHYSCIACEÆ

Genus DIPHYSCIUM

Diphyscium involutum Mitt.

LUZON, Rizal Province, Mount Lumutan, *Bur. Sci. 29828 Ramos and Edaño.*

POLYTRICHACEÆ

Genus RHACELOPUS Doz. et Molk.

Rhacelopus pilifer Doz. et Molk.

PANAY, Capiz Province, Jamindan, *Bur. Sci. 30864 Ramos and Edaño.*

Genus POGONATUM Palis.

Pogonatum microstomum R. Br.

LUZON, Benguet Subprovince, Pauai, about 2,200 meters, *Bur. Sci. 32067 p. p. Santos.*

Pogonatum spurio-cirratum Broth.

LUZON, Benguet Subprovince, Pauai, about 2,200 meters, *Bur. Sci. 32053, 32067 Santos:* Bontoc Subprovince, Mount Pukis, *Bur. Sci. 38264 Ramos and Edaño:* Lepanto Subprovince, Mount Pangualaytacay, *Bur. Sci. 40532 Ramos and Edaño.*

Pogonatum macrophyllum Doz. et Molk.

LUZON, Laguna Province, Mount Banahao, *Bur. Sci. 28012 Ocampo.*

Pogonatum wallisii (C. Müll.) Jaeg.

LUZON, Bontoc Subrovince, Mount Polis, *Bur. Sci. 38237 Ramos and Edaño.*

DAWSONIACEÆ

Genus DAWSONIA R. Br.

Dawsonia superba R. Br.

MINDANAO, Bukidnon Subprovince, Mount Lipa, *Bur. Sci. 38593 Ramos and Edaño.*

BATAN TEXTS WITH NOTES

By Otto Scheerer

Of the University of the Philippines

Batán is the name of the chief member of that group of islands between Luzon and Formosa which is called the Batán Islands or, in an older Spanish form, the Batanes. In English literature the group is found designated as Bashi or Vashi Islands, a name bestowed upon it by Dampier and his men on their visit in 1687 on account of the liberal use made by the inhabitants of a certain beverage known all over northern Luzon as *basi,* a product of the fermented juice of sugar cane.

Only three of the several islands can properly be called inhabited; namely, Batán, Sabtang, and Itbayat. The rest have at best a few huts of detached herdsmen or are only occasionally visited by fishermen. The Census of 1918 gives the group a population of 8,214 souls, distributed over six townships and nineteen barrios or outlying villages. The townships are Basco, Mahatau, Ivaná, and Uyugan on Batán, Sabtang on the island of like name, and Mayán on Itbayat. The capital is Basco which, as a spiritual community, is also called Santo Domingo de Basco, while the people themselves know it as Vasay.

The language of the inhabitants of Batán and Sabtang is fairly uniform; that is, no difficulty whatever exists in mutual comprehension, although the people of different towns allow each other certain local phonetic and lexical peculiarities. They allude to their language as *chirin nu ivatán* (that is, speech of the people of Batán) or occasionally also as *inivatán* (that is, what is peculiar of the people of Batán). The form Batán having once come into use in Indonesian linguistics, I have retained this in the present paper.

On Itbayat a dialect closely allied to Batán is spoken, of which the Batanese proper used to say that it is unintelligible to them, while they themselves are understood by those from Itbayat. I consider the differences marked enough to justify me in speaking of it as a subdialect of Batán.

Of the language of the Ivatán people but little has come to be known so far. Of works dealing with it more or less extensively from a linguistic point of view, as also of such that use it as a means for religious instruction, a number is listed in Blake.[1] The majority of works published is by Spanish authors, and the Spanish orthography applied in these books to Batán does not make them a safe guide for students of Indonesian languages in general. Information on the phonology of Batán is found in the well-known Brandstetter series, in Conant's "The pepet law in Philippine languages," [2] "The RGH law in Philippine languages," [3] and "Indonesian *l* in Philippine languages," [4] and in my "Ein ethnographischer Bericht ueber die Insel Botel Tobago," [5] and in my prologue to "Diccionario español-ibatán por varios PP. Dominicos," Manila, 1914. For grammatical notes see Blake "Contributions to Comparative Philippine Grammar." [6]

Texts taken directly from the mouth of the people, especially from what may be called their unwritten literature, have so far been lacking. The samples here for the first time given, though primarily meant to supply material for linguistic studies, will afford at the same time some insight into certain customs and psychological traits of the islanders, and will show them to possess a certain inclination for poetical conception engendered, it would appear, from their outward circumstances of life.

The natural surroundings in which the Ivatán passes his life furnish him certainly with emotions and events of sufficient intensity to incite to a representation in literary style. The islands are of a great charm, a charm that grows on the visitor as he prolongs his stay: hills and valleys and grassy uplands form an open sunny landscape rich with pastures and fields, the latter hemmed in with flowering shrubs and trees. The almost northern character of the country is offset by a few higher elevations of volcanic origin the denser vegetation of which bears witness to the tropical location. Looking out to sea, the eye rests on a fringe of madreporal shelves over which the blue waves, broken farther out in a line of silvery foam, come lazily rolling in to die out on a beach of fine white sand; or it follows the curving coast line to some rugged promontory with bowlder-strewn foreshore and to the wide ocean beyond. Unfortunately the islands are the theater of very frequent storms: during one half of the year there prevail typhoons with winds from the southwest; during the other half, fierce gales from the north and northeast, all working destruction on land and sending mighty waves from the open surging through the tiny isles. Lucky the year that passes without a boatload of people, trying to reach a neighboring island, being swept away by one of these storms, never to be heard of again. At such times the thatched roofs of the dwellings are kept from being blown away by being firmly tied down with large nets to the massive stone walls of the houses. For the same reason the stalks of sugar cane in the fields must be made to grow up securely bundled together in threes or fours and on reaching a height of about two meters every four such bundles are again tied together by their crowns into a pyramidic group in order better to withstand the onslaught of the storms. The growing of rice, corn, and millet being under such conditions extremely precarious, the people rely for a staple food upon such better protected crops as yams and sweet potatoes, and even these are often washed away by the rainstorms, together with the cultivated soil from the slopes on which they are planted. The people are thus exposed to periods of starvation which are rendered the more serious in that for the greater part of the year all succor from the mainland of Luzon is cut off by the heavy weather out at sea.

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[1] A bibliography of the Philippine languages, part I, p. 68, Jaos, 40, 1.

[2] Anthropos, VII, 920–947.

[3] Jaos, XXXI, 70–85.

[4] Jaos, XXXVI, 181–196.

[5] Mitt. d. Ges. f. N. & V. Ostasiens 11: 2.

[6] Jaos, XXVII, pp. 317–396.

The people are good-natured, law-abiding, and submissive. Their predilection for basi has already been mentioned. Sugar cane is planted in order to obtain, besides some muscovado and vinegar, mainly the raw material for this beverage, the name of which has been changed by the islanders since Dampier's times—perhaps for diplomatic reasons—to *palek* (or *palœk*). The chief place of its production is Basco, a locality favored by nature with a moderate extension of fertile level land, and the preparation and the sale of palek form here a not unimportant branch of industry, while its consumption in general is very far from constituting a degrading tribal vice: it is simply the beer of the hard-working Ivatán people. After the day's work in the fields is done, they like to gather in friendly reunions in their houses where, seated on long benches around the room, they engage over a pot of this palek in animated conversation, exchanging stories and songs. Everyone present is expected to make his contribution to the entertainment; if unable or unwilling to tell a story (*mangununung*) or to sing (*mayladyi*), he may have to redeem himself by a contribution in kind to the common stock of palek. At such occasions there are heard improvisations as well as songs handed down from ancient times. The topic of these songs appears to be mostly the social life of the clan treated with a markedly moralizing tendency. They are characterized by a veiled significance, for which they are called *pinasinmo* (also *pinanmo*); that is, significative songs. Where this veiled speech coincides in ancient songs with "old words" of almost forgotten meaning, the sense is apt to become enigmatical to a degree that even white-haired natives, reputed authorities on their language, fail to agree on a correct interpretation, which makes translation of such songs into English a matter of considerable difficulty. Besides the songs (*ladyi*) sung at social gatherings and which we may compare, in a way, to those of the Tagalog *balagtasan* and the Bisayan *kantahay,* they have others, sung in chorus by field-workers or by boatmen and called *kalusan;* one such will be found among the texts.

The acquisition of my texts was made during a residence in those islands in 1908 and 1909. Charged with the introduction of a new political organization, I had, after a period of some agitation, the satisfaction of securing for them a provincial constitution independent from that of the far-away province of Cagayan on the mainland of Luzon whither they had previously been sending their taxes; in exchange, I had to abandon, to a very large extent, my hopes for a detailed philological study of the people. The description of the voyage of the sailing vessel *San Carlos,* which forms the main part of the present texts, was written upon my request, by an excellent man, native of the township of Mahatau on Batán, of the name of Marcelino Fabro, a representative of that old Spanish culture which was brought to the Batanes by Dominican missionaries and grafted on a preëxistent good native stock. The Ivatán, who, like others, pay spontaneous deference to men of superior ability, esteem especially those who have proved themselves successful leaders at sea, and there was nobody better able to forecast the weather by watching the sea break on the forelands, nobody better versed in the intricate network of currents running through the islands than Fabro.[6] In his manuscript, it is true, he shows himself as sharing the general inclination of his countrymen to make light of the forms and rules of his language; he often wavers between the speech-forms of the capital Basco and his own (Mahatau) localisms, nor is he always consistent in his orthography. Sooner, however, than correct these shortcomings by attempting to establish a standard Ivatán language, which nowhere (not even in Basco itself) exists, I have preferred to point out such differences in the notes, and have restricted myself to replacing wholly inadequate Spanish letters by symbols more in consonance with the alphabet of the International Phonetic Association. Similar remarks apply to the songs which likewise were written down by natives and translated with their help into English, as was done with Fabro's manuscript. No accent marks being used in any of the sources and accentuation being moreover very indistinct in the spoken language, which is of a soft and elusive intonation, special care was taken in this regard in preparing the texts, and different speakers were closely questioned; even so, the result was not always entirely satisfactory. The weight of the voice may be said to fall as a rule on the penult; taking this as a general principle, an acutus was placed only on accented ultimas. The necessity to indicate, by a grave accent, the peculiar abrupt pronunciation given to a final vowel before a glottal check could be established only in a very few cases; this peculiarity may, however, also occur in a number of other words. Some of the most notable inconsistencies to be found in the texts are the following:

The indiscriminate use of *u* and *o*, as of *i* and *e*, in what are identical words. This might have been remedied by using in all such cases one definite letter, if the fluctuating spelling did not reflect an equally wavering pronunciation, a fact of the language it was considered better not to cover up; thus the pepet vowel, which, according to Conant, becomes in Batán as a rule *e* in a final root syllable, and *a* in a penultimate syllable, was heard by me in certain words, and especially after labials, as a distinct *œ*. The suffix containing the pepet is pronounced mostly *-en,* sometimes *-in.* Possibly one of these varying pronunciations may ultimately prevail for all cases; for the present no standard can be established;

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[6] The relation thus created between a leader and his followers is, however, found in the Batanes tempered by a markedly democratic trait. Planning an inspection of a certain township by surprise, I once set out from Basco in a boat rowed by some six men, the helmsman having been given at the start a feigned destination. A few miles out at sea, the order to change the course for the town to be inspected was, however, not so quickly complied with as expected, a consultation first taking place in which the pilot gave the rowers a chance to express themselves on the risk to be incurred by changing the itinerary. A similar prudent consideration of the opinions of one's followers will be found also in Fabro's story; it may, indeed, be a characteristic Indonesian trait for a group of freemen under a leader.

The apparent indifference to a fixed criterion for the use of suffix *-an* to denote the (real or figurative) place of action and of suffix *-en* for the direct object of action, a latitude found, by the way, also in other Philippine languages;

The unstable use made of the forms *u* and *nu,* for the article preceding the subject of the sentence.

It may finally not be superfluous to state that the English of the translations given in the texts is meant to follow the Batán wording as literally as at all possible and that it should be judged only from this point of view.

VIAHE NU PANKO SAN CARLOS	VOYAGE OF THE PANKO SAN CARLOS
Yaken, si Marcelino Fabro, onunungan ku u na viahe chu du awan a 1893:	I, Marcelino Fabro, relate my voyage made in the year 1893:
1. Du vidang a dima nu Hulio du awan a 1893 am minawará u vidarin namen a mahumay a ayukayam as kuminaru	1. On the date fifth of July of the year 1893 (there) came our favorable sailing breeze, a soft northeaster, and we left

Title. *Viahe,* from Span. *viaje,* voyage. My orthography of Batán words follows the general rule of pronunciation; namely, English consonants and Spanish vowels.

Panko, a small sailing craft of less than twenty tons, with deck and mat sails. The pankos of the Batanes, each the common property of the people of one of the townships, and laden by them with pigs, lard, onions, and garlic, used to make one trip a year to Manila, or two to Aparri. They are manned by volunteers from among the freighters.

Introduction. *onunungan ku,* report my, from *onunung,* relate.

u na viahe chu: na viahe is a sort of "perfect tense" of the noun "*viahe;*" compare: *u na tulas ku,* the letter I have written; *chu* (or: *cho*), my, from *ku* (or: *ko*) under the influence of preceding *e* (*i*).

1. *vidang,* number.

1893, read: *asa libu kanu waho yatus kanu siam a poho kanu atdo.*

minawará, perfect of *mawará,* arrive.

vidarin, sailing wind; from *vidad,* sail; *mamidad,* make sail.

ayukayam, northeast wind; other divisions of the wind rose are: N: *idaud;* NNW: *tahuara;* NW: *munmo;* WNW: *maidaud avayat;* W: *avayat;* WSW: *maraya avayat;* SW: *itaaw;* SSW: *paytayua-*

kami du araw auri a mangay du viahe du Aparri; am nu marahet a palak namen am rinawat namen du kayán namen du Canal du Balingtan, tan minaychihat u kapihœxteng na.

2. As dawa nu avấng am nayfirmi a mipaiso a mipangay du taaw du China, am nu taaw am uyud a mauhas as pagchinen namen su bote a mangamong su bedberen namen a yapu du rawo, am du dekéy a mi-

that day to go on our trip to Aparri; but (it was) our bad luck that met us during our presence in the Balingtan Channel; for suddenly a state of calm set in.

2. And therefore the ship kept retroceding going to the China Sea, and the sea being quite smooth, we lowered the boat to fish our bait from a field of floating sea-grass, and after a few minutes they al-

wan (between) *nu sumla kanu avayat;* S: *sumla;* SSE: *paytayuawan nu sumla kanu kuvi;* SE: *kuvi;* ESE: *palahañitan;* E: *pangaditan;* ENE: *paytayuawan nu ayukayam kanu pangaditan;* NNE: *paytayuawan nu idaud kanu ayukayam.*

kuminaru, perf. of *kumaru,* go away.

mangay, go, perf. *nangay;* place whither one goes, *angayan.*

rinawat, perf. of *rawaten,* what is received.

kayán, stay, sojourn; stem *ian,* idea of being in a place; *yanan,* abode.

minaychihat, perf. of *maychihat,* what occurs suddenly.

kapihœxteng, state of calm; the wind lulls, *maxteng* (or: *manghœteng*) *u salawsaw;* here as farther on *x* stands for the voiceless velar continuant.

2. *avấng,* ship, in general; *mayavấng,* go in a ship; perf. *nayavấng;* used in reference to navigating among the Batanes Islands; if implying a departure from the Batanes, as for Manila, the intensive form *mangavang,* perf. *nangavang,* is used. *Pangavángan,* name given Luzon as place where ships go or come from.

nayfirmi from Sp. *firme,* firm; here "continuously."

mipaiso, go backward; *mipa-* generally expresses "to dispose one's self to do what is expressed by the stem;" *iso,* backwards.

mipangay, compare *mipa-* just explained, and *mangay* given above.

taaw (or: *taw,* with long *a*), the sea; Ilk. *taaw,* the deep sea.

uyud, true, very, really.

am, after the subǰect it serves for predication in the manner of our copula; between clauses it appears to indicate simply the progress of the discourse, having sometimes the force of "but."

pagchinen, what is put down; Basco pronounces *pagtinen;* perf. *pinagtin;* put down, *gumtin,* perf. *gumintin.*

mangamong, catch fish, from *among,* fish in general; perf. *nangamong.*

bedberen, object of tying with string, especially the bait fastened to the hook; bait in general is *apan.*

yapu, origin; *makayapu,* with following *du,* = "from."

nutos am mirua daná sira a mayvidi du aváng a mian su papiri among as pasakayan namen daná su bote. Nu salawsaw am mayunung pa ayukayam as nunuyan namen daná su sayrin nu aváng.

ICHAPAT NA KA ARAW

3. Du asa ka araw am minakapat kami su iú. Nu aváng am maifirmi pa a mipaiso a namanda du kasngen namen du Canal Bashi am du kayán namen daná daw am minaychaknin kami du asa ka mavœkhas du kavuya namen su dekéy a uri a isla abnikan su

ready came back to the ship with a few fishes, and we took the boat aboard. The wind continued still in the northeast and we were dragging the ship's fishing tackle (through the water).

THE FOURTH DAY

3. On one day we caught four sharks. The ship was still steadily going back until we were in proximity of the Bashi Channel, and when we were already there we were startled one morning upon seeing that small island there, called Iami, knowing that the people are

rawo, floating patches of seaweed used by small fishes for spawning.

dekéy (or: *dekœy*), small; also name of a small island west of Ivuhos.

mirua, return, repeat; perf. *minirua;* nom. obj. *piruahen*, perf. *pinirua.*

daná, already.

mayvidi, return, perf. *nayvidi; kapayvidi*, the return.

mian, have, be, exist, dwell; *mian u asa vatahen ko dimo*, I have to tell you something, there is something I have to tell you.

papiri (in Basco: *papœrre*), few; stem: *piri* or *pœre.*

pasakayan (radical *sakáy*), what is lifted aboard a ship; we would expect the form *pasakayen* (perf. *pinasakay*) as object of lifting, which might also be used here. Compare farther on: *nunuyan* for *nunuyen*, object of dragging.

sayrin, fishhook; *manayrin*, fishing with such.

3. *asa ka araw*, often contracted to *asa karaw; ka* here seems to help the numeral to present the objects counted as units; compare: *dadua ka vatu*, two stones, etc.

minakapat (from *minaka-apat*) *kami*, got four we; compare: *minakasa ko*, from *minaka asa ako*, got one I; *nakadadua ka*, got two you.

iú or *iyú*, shark; Basco has *íu* or *íyu.*

namanda, until, unto, from *panda*, end, limit.

kasngen, from *asngen*, near; *kasngen namen*, our being near.

daw, from *d* plus *aw*, there.

minaychaknin, perf. of *maychaknin*, who is startled; stem *aknín*, sudden.

uri, that there; often contracted with preceding *a* to *auri, ori.*

isla, Pilot Fabra shows himself here and elsewhere in possession of some knowledge of Spanish; island in Ivatán is *pungsú;* the island meant is Botel Tobago.

Iami a mapanmu namen a dyiasarayan a tao, as du kuanasaori am mavuya namen pa u asa ka isla a uyud a makarang a mavawa pa, as nu kakarangan na u chinakalú namen a makavuya sia.

4. Du makuyab nu nakavuya namen su isla siraya am nairaya kami du asaori du isla abnikan su Iami. Minapnu kami nu kamunu tao a matdá du isla aori du kadekéy nu sakayan namen a maparin da a pisarasarayan; am angu u pariñen namen du masngen daná u kadiman namen nu kawau, as du kapipamahep na am chinañitan ku pava a pagchinen

not to be trusted and after a short while we saw another island, very high, and yet far away; and (it was only) its height made it so early visible to us.

4. In the afternoon of (the day of) our sighting these islands we were nearer the shore of that one island called Iami. We were filled with fear of the people living on that island because of the smallness of our ship which they could damage; but what were we to do, being almost dead with thirst; still, when night fell, I did not yet dare to lower the boat for

abnikan, radical *abnik* (*benek?*), idea of naming.
mapanmu, know, radical *anmu,* signification.
dyiasarayan, negative (*dyi*=not) of a positive *kasarayan,* who is trusted; *dyi* is the palatalized Mahatau pronunciation of Basco *di;* in the present text both forms occur, mostly prefixed to the following word.
kuanasaori, idiom for: shortly afterwards, also for: meanwhile.
chinakalú, perf. of *ichakalú,* what causes hurry; *kalú,* quick; *Angu u ichakalú mo?* What puts you in a hurry? Text says literally: "and the height its [that is, of the mountain] was the cause of our being quick in perceiving it." Evidently Formosa is meant.
4. *siraya,* from *sira* (they) and *aya* (this); *sira* is often used to denote plurality.
nayraya, perf. of *mayraya* or *mayaraya,* going to shore.
kamu, fear; *mamu,* one afraid; radical *amu.*
matdá, dweller; *katdaan,* dwelling place; radical *tidá,* Tag. *tirá.*
maparin, possible; *makaparin,* able to do; *kapakapamarin,* power.
pisarasarayan, from *saray,* damage.
angu, what?; also: thing, as in *angu-angu,* possessions (especially gold and silver): *angu uri?* what is that?
pariñen, object of doing; cf. *maparin* above.
kadiman, death, from *diman,* idea of dead.
kapipamahep, the setting in of night, from *ahep,* night; similarly: *kapisarisari,* dusk, from *sari,* dark.
chinañitan, perf. of *kañitan,* daring; *makañit,* who dares. In Basco: *makanit, kanitan,* etc; radical *añit* (*anit*), acting by one's self.
pava, from *pa,* yet, plus *ava,* not.

u bote a muranúm, as pinatanggalan ku na sira su grumetes du kagchin da anu kapisexsexdang na a manita su ranúm du tana aori a di namen pa chinakaran.

5. Du kamahep daná ori am nakaichéx akuava a namanda du kamaraw. As misexsexdang daná am talamarin namen u tana am maidaud kami du nakapipakaha nu ries, as nu salawsaw am mayunung pa as pakaichéx ku su dekéy am du kuanasaori am vatahen da u kayán da nu sakayan a makahaud a mipangay dyamen, as du nakaknin ku du horas aori am nañieng a mitatayatto u ka-

fetching water and (only) instructed the sailors as to their going down at daybreak to look for water on that land not yet trodden by us.

5. That night I did not go to sleep until daylight. When daylight began to appear, we looked out to the land and (found) we were far out to sea as the current had become slack, and as the wind was still steady, I was enabled to sleep a little, but after a short while they told me of there being boats setting out from the shore and being about to come towards us, and from the con-

muranúm, an "intentionalis" from *ranúm,* water: going for water.

pinatanggalan, perf. of *patanggalan;* radical *tanggal* advise in advance, prepare.

grumete, Span. for "young sailor."

kapisexsexdang, dawning of day; *sexdang,* splendor, irradiance.

manita, who seeks; *chitahen,* object of seeking; radical *chita.*

tana, land, soil, earth.

chinakaran, perf. of *kakaran,* place trodden on.

5. *nakaichéx,* perf. of *makaichéx,* go to sleep.

akuava, from *aku,* I, plus *ava,* not.

misexsexdang, getting light; *masexdang daná u araw,* the sun is already shining; Tag. *sumilang,* rising of sun, moon, or stars; *silangan,* the orient.

talamarin, object of spying out; radical *talamad.*

maidaud, being far out in the open sea; cf. *idaud,* north wind.

nakapipakaha, radical *kaha,* weak.

ries (*riyes*), current; the two chief currents setting through the Batanes are one from northwest to southeast, known as *isāk,* and one in the opposite direction, called *amteng;* they coincide and change with the tides.

vatahen, obj. of saying, perf., *vinata; makavata,* say.

makahaud, setting out from the shore.

horas (Span.), hours, here: time.

nañieng, suddenly (Basco: *nanieng*).

mitatayatto (Fabro's spelling) *u kalangangan ku,* literally: my stomach rising strongly. Compare: *Makatayato ava,* He makes no langangan ku a malakám nira nu dyinamen pa siraya a navuya.

6. Du katalamad namen su sakayan sira ori am tatdo sira kasakayan am nu asa dira am miñirua a mayvidi am kayán nu kauyud namen a mamu, ta du kaidaud namen as kapakañit da a rumanun dyiamen am chinanggal namen u kaheyet da kanu kanaub nu vuhó da as kapanmu namen pa su nanma kañiamen a nangay daw a ñidiman da as kahap da su ichakey da du aváng aori.

sternation I felt at that time suddenly my heart leapt into my mouth from a violent fear of those whom we had never seen before.

6. On closely observing them (we found that) these boats were three and one of them turned to go back, and we were truly alarmed because, we being so far out at sea, their daring in coming out to us forewarned us as to their strength and sufficiency of arms, and we knew besides (that) those who had before us gone there had been killed by them and they had taken whatever they wanted from that boat.

effort; *nakatayato dana u araw*, the sun has already risen and is burning hot.

malakám, most often used to express strong desire, but applicable also to other strong affections, as, in this instance, violent fear.

6. *miñirua*, Mahatau pronunciation of Basco *minirua*, perf. of *mirua* (under).

kauyud, truth, genuineness, of *uyud* (see under 2).

kaidaud, being far out at sea; cf. *maidaud* under 5.

kapakañit, daring; cf. *chinañitan* under 4.

rumanun, radical *ranun*, idea of proceeding to another place.

chinanggal, perf. of *tanggalen*, that which is told to somebody in advance; cf. *pinatanggalan* under 4. Note *t* changing before *i* to *ch.*

kaheyet, strength; also the form *kayit* is found: *kayeten u kuman*, a glutton; *ichait mo u dima*, press the hand; radical *ait* (*ayit*).

kanu, and; probably *kan* plus an enclitic *u*.

kanaub, sufficiency; *manaub*, sufficient.

vuhó, *vuhú*, arms of any kind; *mayvuhu*, arm one's self.

kapanmu, cf. *mapanmu* under 3.

nanma, from *nanuma*, what is first.

kañiamen, from *kan* plus *iamen*, here: "than we."

daw (*d* plus *aw*), in or to that place, there.

ñidiman (Basco: *nidiman*), perf. of *dimanen*, object of killing.

kahap, radical *ahap; manghap*, take; *ahapen*, object of taking.

ichakey, object of desire.

7. As dawa naori u pinakayapuan nu kavata ku sia dyira du atavu a kasakáy cho u umunot aya:

(1) "Nu manumma a pariñen ñio am nu kapakaru ñio sia du lakasan u ahahawen ñio a ichahuhu da, akma su pulak, vuhawan, anmana angu pa a bayuan ñio as kapangay ñio sia du dyinahahawa a yanan nu bayuan.

(2) "Nu mapéyya ayuayub ñio a maidak am unayen ñio tapianu dyida sinchad u kaivatán ta a mapanmu da abú su vuhó.

(3) "Nu katanggal ñio su

7. And from that (came) the inducement of my addressing to them, to all my shipmates, this the following:

(1) "The first thing to be done by you is to take out of the chests the objects you suspect to be desired by them, such as silver, gold, or whatever you would be sorry to lose and to put it in a place not suspected (of the presence) of objects it would be a pity to lose.

(2) "Your best white clothes will be put on by you in order that they may not recognize our being Batanes whom they know to be without arms.

(3) "Prepare wooden clubs

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7. *pinakayapuan*, radical *yapu*, origin; *Yapu ka dinu?* From where you?
kavata, cf. *vatahen* under 5.
kapakaru, cause to get out.
lakasan, chest, box; cf. Ilk. *lakasa*, same meaning, probably fr. Sp. *la caja*.
ahahawen, object of judging, believing, suspecting; perf. *inahahaw;* one who judges, etc., *mangahaw*.
ichahuhu (*ichahoho*), object of desire, perf. *chinahuhu;* alternative form: *ihuhu*, perf. *nihuhu;* one who desires, *mahuhu*, perf. *nahuhu*.
akma, used in comparison: as, like, similar to.
bayuan, radical *bayu*, pity felt over what can be, or is, lost; hence *bayuan* object of such pity.
dyinahahawa, from *dyi* plus *nahahawa*, unsuspected.
yanan, cf. *kayan* under 1.
mapéyya, best; *mapia*, good; *mapipia*, better.
maidak, white; synon. *marelak;* of persons: *maray*, *madadas*.
unayen, object of putting on in dressing; *mangunay*, dress one's self.
sinchad, radical of *masinchad*, know, recognize; *Angu kasincharan mo diaken?* How do you know me?
katañggal, cf. *pinatañggalan* under 4, and *chinanggal* under 6; note the abundant use made of abstract nouns with prefix *ka-*, especially the *nomina actionis* (with perf. in *china-*); cf. under 1: *kayan*, *kapihœxteng;* under 3: *kasñgen*, *kakarañgan;* under 4: *kadekéy*, *kadiman*, *kagchin;* under 5: *kamahep*, *kamaraw;* under 6: *katalamad*, *kaidaud*, *kaheyet*, *kanaub*, *kapanmu*, *kahap;* under 7: *kavata*, *kapakaru*, *kapangay*, *kaivatán*, and many others to follow.

vuhó ñio a kayo a dimipánaru kanu atdo a rangan, lukoy, kanu kapatuaw su vatu a lastre a maparin a iraraya w su sakayan da anu marahet u pariñen da.

8. (4) "Piahen sirava a sumakáy du avắng aya, as anu sumakáy sira am inulay nu Dios u kapandiman ta.

(5) "Arava u mandiman anu dichu pa a vinata kanu andyipa inahés dyiaken ta Cristiano ta." Katavuan namen a tao nu avắng am atdo poho kanu asa. Minaychatdo u tao nu avắng; nu asa poho am pachunungan da u avắng du atavu a mayanung a pariñen; akma su kapaibira, as kanu kadduan pa. Nu rua poho am micharua a mayviit du siri abú su pasakayen.

not longer than three spans, cleavers, and fetch stones from the ballast capable of smashing their boats if their acts (were) bad.

8. (4) "They are not permitted to come on board this ship, and if they come on board, it will be permitted by God that we kill (them).

(5) "Let there be none that kills before I have said so and (the question has been) referred to me, for we are Christians." The total number of us men on board the ship was thirty-one. The men of the ship were divided in three parts: ten were to look after the vessel regarding all necessary work, such as the turning the ship about and other things. The (other) twenty men were to divide in two parts and to go to the sides (of the ship to see that these were) not to be ascended.

dimipánaru, radical *ánaru*, long.

8. *piahen*, what is allowed, sanctioned; from radical *pia*, idea of good; cf. *mapéyya* under 7.

sirava, from *sira* plus *ava*, they not.

inulay, what is tolerated; radical *ulay*, idea of will.

kapandiman, homicide, slaughter.

ta, inclusive form of pers. and poss. pronoun of the first pers. pl.

dichu, from *di*, not, and *chu*, my.

andyipa, from *anu* + *dyi* (*di*) + *pa*, if not yet.

inahés, perf. of *iahés*, object of inquiry.

katavuan, from *atavu*, all.

minaychatdo, perf. of *maychatdo*, being divided into three parts; *ka-* or *icha-* before cardinals makes ordinals (*u ichasa*, the first, etc.) and *may-* or *mi-* before these expresses a division into so many parts as the cardinal denotes: *michatdo u takey aya*, this field is divided in three parts.

9. Du katayuka na naori am inahés ku dira anu mayunung aku a manyuku-yukud da anu akmay marahet u pariñen da dyiamen, anmana mian pa u mipapia pa kañiaken a maparin abneken a machitadi: am vinata da u kapayunung ku a manyukuyukud da; as dawa naori u vinatán ku sia dira u umunot aya:	9. At the conclusion of this I inquired from them if I was to continue commanding them if any injury (should be done) by them to us, or if there were one better than I, whom they might appoint as (my) substitute: their declaration was (for) my continuance as their commander; and, upon this, what I told them was the following:
(1) "Du kayapu na dyiñio nu masaray ñiaken du akmaya sia a kavaklan ta am arava u dyiñianuhed du atavu a vatahen du dyiñio.	(1) "Since you have confidence in me in these straits of ours, let there be none who does not obey everything I tell you.
(2) "Mitavu ta a makey a maviay am anu sinu u mavuya	(2) "We all of us wish to live, and if one is seen by me who

pachunungan, from *unung,* idea of caring for something.

mayanung, being convenient.

kapaibira, radical *bira,* probably from Sp. *virar,* to tack.

mayviit du siri, appears redundant, since *mayviit* is "to go to the side" and *siri,* side.

9. *mayunung,* remain, continue; cf. under 5: *nu salawsaw am mayunung pa.*

mipapia, one who improves; here "one who surpasses me;" cf. *piahen* under 8.

marahet u pariñen da, lit. bad the deeds their.

abneken, what or who is appointed; *mamnek,* who names; cf. *abnikan* under 3.

machitadi, radical *tadi,* idea of relieving.

vinata, perf. of *vatahen,* what is said.

vinatán (second *a* long), perf. of *vatán* (*vata* plus suffix *-an*), same meaning as *vatahen.*

kavaklan, radical *vakel,* trouble, difficulty.

dyiñianuhed, from *di* + *nia* + *anuhed,* lit. "not-his-obedience."

mitavu, from *atavu,* all. Prefix *mi-* in Ivatán appears to bring the sense of the radical in still closer connection with the carrier of the predication than is generally the case with affix *um* with which *mi-* may be related.

makey, one desirous.

mavuya ku, object of my seeing.

ku a umiso du contra as pakasakayan da u sinmu na am yaken u rumanis a umdiman sia du horas auri."

10. Du kavuya ku su kapanhavas nu kapáw kanu kamu namen atavu am miparakúx u kamu ku, tanu kaduan dyiamen am makapaidyiwadyiway pava du kapanghavas nu kamu, as vatán ku sia dira u kadyi da amuan ta du kavuya su sakayan da a mipadekéy kanu sakayan namen am katadkan nu sumayap dira, as nu dyinayap, am mitavu sira a manahan du ngalab a mauhamek a talahen nu tumanggal sira. "Aranu mian dyiaten u rakúx a kamu

recedes before the enemy, and gives cause to their invading (lit. 'mounting') his assigned post, I personally shall kill him at that time."

10. Upon my seeing the excessive despondency and fear in all our midst (lit. "of all of us"), my alarm increased and some of us were motionless with excess of fright, but I told them that they be not afraid for, evidently, their ships were small against our ship so that, unless they (could) fly—and (they surely) could not fly—all of those that passed the gunwale would be easy to be caught by him who was prepared for them. "Although there is

umiso, cf. *mipaiso* under 2.
contra, Sp. "against;" accepted in Ivatán as meaning "enemy."
sinmu, cf. *mapanmu* under 3.
rumanis, who acts personally; radical *ranis*.
horas, time; from Sp. *hora*, hour.
10. *kapanhavas*, radical *havas*, idea of exceeding.
kapaw, dejectedness; radical *apáw*.
miparakúx, radical *rakúx*, great; Ilk. *dakél*, same meaning.
makapaidyiwadyiway, radical *dyiway*, idea of moving.
pava, from *pa* + *ava*, no more.
u kadyi da amuan: u seems to have, here as in other instances, the force of introducing a succession of words as one whole object of thought, this being moreover rendered possible by prefix *ka-*, of *kadyi*, and suffix *-an* of *amuan*, comprehending *dyi da amu* into a sort of abstract expression: "their being without fear."
ta, because.
katadkan, excepting; radical *tarek*, idea of distinction; cf. *Patadkin mo sira*, Put them apart; *Pinatarek ku na*, I have already put them apart.
manahan, one who passes through a door, street, etc.; from *rahan*, way.
ngalab, edge, sharp edge of a knife; in ships: the gunwale.
mauhamek, what is easy.
talahen, what is caught (with the hands, etc.) from afar; radical *tala*.
aranu, although.

am ipavuya tava u kamu as pariñen ta u kakmay dyinanggalan sira kanu kadyinangán nira as nu ravel am patuawen ñio as kapaysunata ñio, as iñio a kahénakan am micanción kamu."

11. Du kachidib namen dyira du sakayan auri am mipasngen daná sira, as patuawan da su vodiadong as kalup da dyia su minaypisa am nañieng sira maywayan u dadua ori a kasakayan su dekéy as nu asa dyira am navidin pa a maiwayam, as nu asa am kuminatuvu a mipangay dyiamen.

among us great fear, we (must) not show the fear, but act like not preparing for them and not paying attention to them; and bring out the violin and play some sonatas, and you, young fellows, you sing."

11. Upon our seeing those in the boats coming nearer, they [that is, our crew] brought out the vodiadong and blew it once, when of a sudden the two boats stopped a little, though only one of them remained tarrying, while the other proceeded coming towards us.

u kakmay dyinanggalan sira, "a manner of unconcernedness as to them;" cf. above: *u kadyi da amuan.*

kadyinangán, from *ka-dinangá-an; dinangá*, not pay attention, from *di* (not) and a radical *sangá*, having probably the original meaning of "branch;" cf. *mapasangá*, be able to do something for not being impeded by other occupations; *dina pasangá*, can not do it; *dina yakin sinangá*, he paid no heed to me.

ravel, from Sp. *rabel*, a kind of small violin.

patuawen, what is caused to come forth; radical *tuaw*, idea of issuing.

kahénakan (or *kahóenakan*), a collective form of *kanakan*, young people.

micanción, from Sp. *canción*, song.

11. *kachidib*, radical *tidib*, idea of looking; *tibi pa!* (or *tib pa!*), look at it! *tiban*, what is looked at.

patuawan, used here alternately with *patuawen* (q. v. under 10); there seems to exist in Ivatán speech a certain indifference as to the use of derivatives in *-en* or *-an*.

vodiadong, a big conical shell, about a foot long, used as a horn for calling people to assemble.

maywayam, who is chatting without accomplishing anything.

kuminatuvu, perf. of *kumatuvu; kumatuvu ka!* Pass on! the formula used to invite somebody into the house: "Come in!"

DU KAWARA DA DU AVÁNG ICHADIMA KA ARAW

12. Du nakapakarapit darana du aváng am pakapian namen dana dyira su Dios nu chirin nu español kanu tagalog am chinbai dava. Kahes da ñia anu iangu kami, nu chirin da am mapanmu u rayarayay na ta machitbin du chirin nu ivatán. Nu chinbay namen am: "Tagalog kami." Nu vinata da: "Iami kami." Du kuanasaori am mapatuaw sira su asa ka tavayay a ranúm. Yamen a taytoo a mapnu nu kawaw am vinata namen u kaskéx namen ñia kanu kapilenlen namen.

AT THEIR ARRIVAL AT THE SHIP THE FIFTH DAY

12. When they had arrived at the ship, they were greeted by us with God's cheer in Spanish and Tagalog, but there was no answer from them. They asked what people we were, in their language, and we understood parts of it, for (it was) similar to the speech of the people of Batán. Our answer was: "We are Tagalog." They said: "We are Iami." Meanwhile they had brought forth a calabash of water. We were very thirsty, yet we expressed our refusal of it and shook our heads.

12. *nakapakarapit*, radical *rapit*, idea of arriving, nearing.

pakapian, radical *pia*, good; the ordinary greeting in the Batanes is *Kapian ka nu Dios!* about: The grace of God to you!

chinbay (in Basco: *tinbay*), perf. of *atbayen*, what is answered; *tumbay*, one who answers; radical *atbay*.

dava, from *da*, their, plus *ava*, not.

kahes, radical *ahes*, idea of asking.

iangu, from *angu*, what, with tribal prefix *i*-.

rayarayay, radical *rayay* (Basco: *dayay*), part; *kahœrayay*, companion in going somewhere.

machitbin, said of things which lack little to be equal; possibly from radical *tidib*, cf. *kachidib* under 11.

taytoo, idea of finding one's self, of being. This idea finds expression likewise by *are* (*ara*) and *mian:* "It is here" may be *are, mian,* or *too dia.*

mapnu nu kawaw, lit. "full of thirst."

kaskéx (*kaskóex*), radical *askéx*, idea of unwillingness.

kanu, and; also *kan* occurs; these are used between common nouns, as in *inapuy kan* (or *kanu*) *among*, rice and fish, or to connect sentences as above. At the beginning of a sentence mostly *as* is used: cf. *As dawa* etc. at the beginning of paragraph 2. Sometimes *as kanu* is said. Between personal names *kani* is found: Peter and John, *si Pedro kani* (or *kan*) *Huan.*

kapilenlen, radical *lenlen* (*linlin*), idea of shaking (the head).

13. Nu kapatalamad su ichaskéx am chingpóex da u taydidekéy daná nàluto nu ranúm du angaangang sira uri as kapayadis da sia du asa ka dyidiaw as katurux da ñia dyiaken as inuman ku dyia as kapabukbuk ku na su rayay na a mabuya da; am nauri u pinabhesan darana su ranúm auri. Minakalu u kapatuaw da su ñioy a iturux dyiamen am ichakey namen ava. Vatán ku su kapatuaw da su ñioy a masadít as mian pa u vonut a mauhamek as patuawan da sia a ipavuya sira, am nauri u pinabhesan darana sia.

13. In demonstration of (our) unwillingness they [that is, our crew] gathered the very few drops of water in all those pots and filled them into a bottle and gave this to me, and I drank it, and part of it I spilt before their eyes, and this made them cease (offering us) that water. Promptly they brought forth coconuts to give to us, but we did not want them (either). I told (our men that) they bring out some coconuts (of ours), but these were difficult (to get at), and as there were also husks of coconuts and these were handy, they brought them out to show them, and that caused them (the Iami) to desist.

14. Nu maday du patuawen da sira ori am vatahen da:

14. With each object of those brought forth by them they

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13. *chingpœx*, perf. of *akpœxen*, what is gathered together, joined; *kakpœxan*, congregation.
   nalutò, drop, stated to be a Mahatau localism for the more general *nayeteng* of same meaning.
   angang, large waterpot; *angaangang*, a number of such; as here, plurality of articles finds often expression by reduplication minus the last sound: cf. *ayuayub* (7), *rayarayay* (12), *kani-kanen* (15).
   kapayadis, radical *adis*, idea of filling over liquids.
   dyidiaw (Basco: *didiaw*), bottle.
   katurux, radical *turux*, idea of giving.
   kapabukbuk, radical *bukbuk*, idea of upsetting; *Pabukbuken mo!* Upset it!
   pinabhesan, radical *abhes*, idea of ceasing.
   masadit, what is difficult; contrary of *mauhamak* (cf. under 10), what is easy. The nuts were probably stowed away where they could not be got at without a sailor leaving his post for some time.
   vonut, the fibrous husk of the coconut.

14. *maday du patuawen*, each of the brought out objects; *maday du tao*, each person; also *mangday* occurs: *mangday su vuhan*, every month.

"Ié!" du katurux da ñia dyiamen u angu siraya mitutuaw, am isanga da sirava nu kaduan aya dyiamen ta mayfirme sira maycanción kanu kapayravel da. Tayuka sira ori am mirua sira a mapatuaw su among a you am minakalu u kapatuaw namen su among a you ta minadpon pa u pawpaw namen a you. As du kavuya da sia am nañieng da a pabhesen, as kapatuaw da su viñivex kanu bilaw, am arava dyiamen, as pavuya namen dyira u tayunkad nu kaskéx namen ñia.

15. Nu nadpon sira ori a kanikanen a iturux da dyiamen am arava u pakayapuan nu kaskéx namen ñia as rakúx u katanggal namen sia a ichamu

said: "Ié!" in handing out to us these things as they came out, but no heed was paid them by the rest of us who went on singing and playing violin. When those (things) were finished, they yet brought out shark-fish, but quickly we too got out shark, for we had still plenty of sun-dried shark. And upon seeing this they at once desisted and got out bananas and winnowing baskets which we had not, but we showed them signs of our unwillingness regarding them.

15. As to those plentiful provisions which they offered to us, there was no (other) reason for our dislike for them but our great preoccupation

ié, evidently an interjection accompanying the exhibition of objects, equivalent to Ivatán: *Tiya!* Inibaloy: *Iay!* French *Voici!*

angu, thing; see under 4.

isangá, cf. *kadyinangán* under 10.

kaduan, the other one, or ones; cf. *mirua* under 2. Ilk. *kaduá* companion.

mayfirme, cf. *nayfirme* under 2.

tayuka, term expressing the idea of finished in general.

you, another spelling of *iú* or *iyú,* shark (see under 3).

minadpon, stem *adpun* (also *apon*), idea of accumulation, plenty: *nadpun a manumanúk,* a flock of birds.

pawpaw, name for the operation of cutting open and spreading out a fish for sun-drying.

viñivex (or: *viñivœx*), general name for bananas; *tul* (long *u*) *nu viñivex,* banana shoot; a special kind of banana is *soten* (or: *suten*), strips of the leaves of which give material for different articles of primitive dress comprised under the name of *sut* (long *u*); cf. Tag. *suot,* dress.

tayunkad, sign; what bears a sign: *matayunkad;* what is to be signed: *tayunkaran.*

15. *kanikanen,* provisions, eatables.

pakayapuan, motive; radical *yapu,* origin.

katanggal, radical *tanggal,* idea of anticipating, preparing; cf. under 4.

ichamu, cf. *kamu* under 4.

anu nauri u pakayapuan nu rarahan da a sumakáy dyiamen anmana mian pinangay da a veneno. Sichanguriaw am mangdaw daná sira su pinuspús a kedked da am makaktu kami ava. Du kadí namen a makaktuan dyira su pinuspús am nauri u tungduhen da a ichakey a panghapan u vidad (lona) kanu kapanahes da su pulak am arava u chinurux namen dyira. Du kabu nu maktu namen dyira du ichahoho da ya am kuminaru sira a mangay du rarayay da ori.

16. Du nakarahan nanaori am vinata ku dyira du kasakáy chu sira ori: "Taori, sira

which made us fear that these (articles) be but a way for their coming on board, or that poison had been put into them. Presently they asked us for ropes to make fast (their boats to our ship) but we did not consent. Upon our not granting them the ropes they showed, by pointing their fingers, the desire to obtain the sail (of our ship which was of canvas) and they asked for silver, but nothing was given them by us. Nothing being granted them by us of their desires, they went away to their companions.

16. This having passed, I said to my shipmates: "Look there, they are gone, but we

rarahan, way, road, here: pretext.
sumakay, cf. *pasakayan* under 2.
pinangay, perf. of *pangay,* radical *angay,* idea of going.
veneno, (Sp.) poison.
sichanguriaw (or: *sichangu yaya*), now at once.
mangdaw, term for begging if done among equals.
pinuspús, rope; radical *puspus,* idea of twisting.
kedked, idea of tying one thing to another.
makaktuan (*makaktu, maktu*), radical *aktu,* idea of granting a request. For the force of "*Du ka. .*" introducing the phrase "*di namen a makaktuan*" ("not our granting") cf. "*u kadyi da amuan*" under 10.
tungduhen, radical *tungdù,* idea of indicating by pointing the finger.
panghapan, radical *ahap,* idea of seizing, taking.
lona, Sp., canvas.
kapanahes, radical *ahes,* idea of begging.
pulak, silver. Cf. my paper "Ein ethnogr. Bericht ueber Botel Tobago" (p. 187) anent the value put by these islanders on silver.
ichahoho, radical *hoho,* idea of desiring.
kabu, from *ka* + *abu,* there is not. Cf. under *makaktuan* above.
rarayay, see *rayarayay* under 12.

16. *nakarahan,* with preceding *du* and following *nanaori* this phrase may have come to be accepted as equivalent to our "thereupon;" I have translated it more literally; stem probably *rahan,* way.

kuminaru am masarasaray tava as talamarin ta sira, ta mapia anu ara siranchi a makaraya daná am anu ara da sira iangay a tawagan u raray da ori, am marahet anchi u pariñen da naori as kanatunan na anu mahoerayay sira a mipaye dyiaten as kapaisiay danchi a mayviit du avàng aya, ta dyihammo u kaiyán nu ichakey da a pariñen a marahet dyiaten."

17. Naori am dekéy u nakapisisirin da as kapirua darana a mayvidi a nayrayay a mipayi dyiamen as mavawawavawa pa sira am maysiay dana sira a mayviit anchi du sakayan namen. "Du kataytoo da a minarin su chinanggal ta a umanam a pariñen da am iñio a ruapoho am micharua kamo a

must not be confident and must observe them, for well they may be going ashore hereafter, yet, if they are going to call their companions there, bad will afterwards be their deeds, and especially so, if they go together in coming towards us and then separate so as to go to both sides of this vessel, for there exists certainly the wish to do evil to us."

17. (As for) those (islanders) they had some little talk and at once they again returned keeping together as they came towards us, and when they were yet a little distant, they separated so as to go then to both sides of our ship. "Since they are doing what we expected to be their future acts, you

dyira du kasakay chu sira ori, lit. "to them, to my shipmates they there." No attempt is made by me to render in the English text the abundant use made of demonstrative particles in Ivatán.

taori, look there! Cf. *Tiya!* Look at this! *Tauri daw!* There it is! *Tauri diá!* Look, here it is! etc.

masarasaray, one who trusts.

tava, from *ta,* we (incl.) plus *ava,* not.

mapia anu, good if.

siranchi from *sira,* they, plus *anchi* (Basco: *anti*), afterwards.

makaraya, cf. *nayraya* under 4.

kanatunan na, especially; possibly from a radical *atu,* cf. Tag. *umato,* make up one's mind.

mipaye, radical *ai* (pron. *a-i*), idea of coming; derivatives of this radical are written in the Batanes generally with *y* for expressing the glide from *a* to *i,* and often with final *e* for *i: mayi kaye, kakaiyan,* etc.

kapaisiay, act of separating; radical *siay.*

danchi, from *da,* their, and *anchi,* afterwards, then.

dyihammo, certainly; an alternative form is *dinghamu.*

kaiyan (*kaian, kayan*), existence; stem *iyan* or *ian,* idea of being in a place; *Mian daw si Pedro?* Is Pedro there? *Ara dinu u ianan nu vahay mo?* Where is the location of your house? Cf. *kayan* under 1.

mangay du binenek kaichi a lugar ñio. Sira u grumetes am natalangpús dana sira du siri nu avång a malit su kavawavawa a mipondan du garrote a dyida vuya nu contra."

18. Du nakawará darana am mavuyvux a pinarin da u kapachinadnad da du avång a tumidib du pakasakayan da, as du kabu nu mavuya da a pakasakayan am naori u vinata da u kapakaraya namen ta arava u manamsam, manulib, as kanu katungdo da su hañit. Nu vinata nu asa dyira am: "Makaraya kamu ta mian sira u bagu, manúk kanu kaddin." Nu mavuya a chinaru da am nu kavuya da su katanggal sira

twenty go back to your previously assigned stations. The young sailors are to stand in file at the side of the ship at equal distances and carrying a club in their hand that must not be seen by the enemy."

18. When they had arrived, the only thing they did was to be close to the ship looking for a means of coming on board; and when they did not see the possibility to come on board, they said that we should come on shore for there were no pillagers, sorcerers, and they pointed with the finger to heaven. The words of one of them were: "Come you to the shore for there are pigs, chicken, and goats." What was

17. *nakapisisirin*, radical *sirin*, idea of speaking; *sirin* is used only joined to affixes, while the synonymous form *chirin* occurs also alone.
mavawavawa, radical *vawa*, idea of distance.
kataytoo, cf. *taytoo* under 12.
umanam, probably prefix *um* before a radical *anam* which appears to refer to "what is yet to come," as well as to "what is anterior" to such coming event; cf. *Too pa manam*, it is yet to come; *kanam nu kauyab*, before supper.
binenek (or *binnek*), perf. of *abneken*, object of naming; cf. *abneken* under 9.
kaichi (or *kaiti*), before, previously.
lugar (Span.), place.
natalangpús, arranged in file.
malit, radical *alit*, idea of being equal.
mipondan, who carries something in the hand.
garrote (Span.), cudgel, bat.

18. *nakawará*, cf. *minawará* under 1.
mavuyvux, single, sole.
kapachinadnad, cf. *machinadnad*, being so close to one another as to touch each other.
kabu, see under 15.
manamsam, radical *samsam*, idea of pillaging.
manulib, sorcerer, poisoner; cf. *masulib*, wise, clever.
as kanu, cf. *kanu* under 12.

ta sira u grumetes a machunong auri du sakayan a piparaparawatan da u rarakúx sira a vatu a pasapaten du palapala.

seen to be the motive of their going away was when they saw the preparations for them, because the sailors who guarded the ship passed from hand to hand big stones to be put on the gunwale of the vessel.

19. KAPARIÑIAN NU SAKAYAN KANU TAO

Nu sakayan am akmay falua su karakúrakúx a maisamorong a matarem as kanu makarang su lachid a mañima du pañivichivan, machideb du regala nu pontin. Nu mian pa a hurán da am kayu a mintíd a chinarin kanu vatu a akmay valachinuk su karakúrakúx. Sira u tao am arava u laylay da as

19. THE MAKE-UP OF THE BOATS AND THE MEN

The vessels are like a falua in size, both extremities sharp and with high (stem and stern-) posts which rise over the waist (of the boat) and equal in height the gunwale of the pontin. The cargo which they also had were sticks, each sharply pointed, and stones of the size of a valachinuk. The men had

hañit, sky, heaven. On the religious beliefs of the islanders of Botel Tobago see my paper cited under 15.

sira u bagu and the following *su katanggal sira, sira u grumetes* show the use of *sira* for indicating the plural.

chinaru, perf. of *icharu,* motive of going away.

machunong, who takes care of something.

piparaparawatan, radical *rawat,* idea of putting something into another's hand and thus serving him.

pasapaten, radical *sapat,* idea of putting one thing upon another.

palapala; the general meaning is that of an horizontal espalier for training vines; here perhaps some spars attached to the gunwale of the ship.

19. *kapariñian;* radical *parin,* idea of making.

falua Span., name given in the Batanes, as elsewhere, to open boats of European build for rowing and sailing.

maisamorong (*maisamurong*); radical *morong,* extremity, specifically stem and stern end of boats; *kasamorong,* one extremity; *isamorong,* inhabitant of one of the outlying villages.

makarang, radical *karang,* idea of high.

lachid, the stem and stern-posts of a vessel.

mañima (*manima*), what juts out.

pañivichivan, waist of a vessel.

machideb, what is equal in height.

regala nu pontin; regala (Span.), gunwale; *pontin,* term used by Spaniards and natives in the Philippines to designate a small sailing vessel, of more or less European build and rig, engaged in interinsular trade. Here the same as *panko,* q. v. under Title.

machivuyvux u sagut da as nu gugud da am akmay chintib a ñioy kanu kayán nu savadi da a pachipungan nu sinuhut da a dedekéy a malialit. Nu vidang da nu dadua auri a kasakayan am ruapoho kanu asa su kapahad o katao.

20. Nu makuyab nu nakapachisiay darana dyiamen nu Iami auri am naywayam kami pa su dekéy makayamot du karakúx nu kavakel ko nu kabu daná nu ranúm namen am pinahes ko sira u kasakay chu sira ori anu piahen da kanu makey sira a kumatuvu du Formusa am vinata da u kapainulay da dyiaken as nañieng namen dana a piweswesen u

no shirt and only a loin-cloth and the cut of their hair was like a halved coconut, and they had bandoliers for hooking on their knives which were small and uniform in shape. The number of men in these two boats was twenty-one souls or persons.

20. On the afternoon when those Iami parted company with us, we tarried yet a little on account of my great concern over our lack of water, and I asked my shipmates if they approved and were desirous of passing on to Formosa, and they said that they left it to me, and we at once turned the ship round to put her on a course to Formosa. At daybreak we

hurán, cargo of ship, wagon, etc.

mintíd, each, one and all; Mahatau really pronounces *minchíd.*

valachinuk, a small kind of sour orange.

laylay, shirt.

machivuyvux; radical *vuyvux*, cf. *mavuyvux* under 18; prefix *machi-* as a rule adds to the stem the sense of an activity exercised in association to others by way of a helper. I cannot say if the text conveys a sense of irony, as we might perhaps say: "Their nakedness was relieved by a solitary loincloth."

gugud, hairdress.

chintib, perf. of *aktiben*, object of cutting across.

savadi, band passing over the right shoulder and under the left arm.

pachipungan, hook or ring for an appendix; *pungan*, pillow.

sinuhut, knife, lit. "what is sheathed," from *suhut*, sheath. Cf. photographs accompanying Dr. Torii's Kōtōsho Dozoku Chōza Hōkoku, as also in his "Les Aborigenes de Formose," Journ. Coll. Sci., Tokyo **28** (1910) Art. 6, a few of which are reproduced in my "Inselkette zwischen Luzon und Formosa," Mitt. d. Ges. f. N. & V. Ostasiens, 11: 1.

o (Span.), or.

20. *makuyab*, afternoon; *kamakuyab*, yesterday afternoon; *kaminsakuyab*, the afternoon of the day before yesterday.

avång a palunguhen du Formusa. Misexsexdang am masngen kami du dekéy a isla a masngen daná du Formusa. Nañieng kami a mamenek su gumchin a mañita su ranúm.

were near a small island[7] off Formosa. We at once appointed those who were to go from the ship to look for water.

ICHANEM A KA ARAW

21. Hora las 7 a. m. Du kapakarapit namen du asaori a kadekéy a isla am ñieng namen a pagchinen u bote as kagchin darana nu binenek auri a mangaud (anem a katao kanu asa ka piloto) as kapanaivi da nu asa ka angang a puranúm da, as du kasngen darana du tana am mian sira u mayhahaw a sakayan da ori a mitataaw as nu asa dyira du sakayan auri a hahawen a yanan nu cabecilla da am chinawagan na konó sira u kaduan auri a sakayan a masesngen dira a machivayat du

THE SIXTH DAY

21. At 7 a. m. Upon our nearing that small island we at once lowered the boat and down into it went those appointed as oarsmen (six men and one boatswain) and they took with them a large-mouthed earthen vessel for water, and finding themselves near the land there were a few boats of those fishermen and one of those boats was supposed to have on board the headman of them, for he called, as it was said, those other boats nearer to them to meet the (ship's)

kavakel; cf. *kavaklan* under 9.
piahen; see this under 8.
kumatuvu; see this under 11.
kapainulay; cf. *inulay* under 8.
piweswesen, radical *weswes,* idea of turning round, or veering a ship; synon. *birahen;* cf. *kapaibira* under 8.
palunguhen (radical *lungu*), what is caused to take a course.
mamenek; cf. *abneken* under 9, *binenek* under 17.
gumchin (Basco: *gumtin*), who goes down (here: from the ship); cf. *pagchinen* under 2.
mañita (Basco: *manita, manta, kumita*), radical *chita,* idea of searching; *chitahen,* what is searched for.
21. *ñieng,* same as *nañieng* q. v. under 5.
mangaud (*ma-nga-ud*), one who rows, radical *kaud,* oar; *kauren,* the boat as object of rowing.
kapanaivi, cf. *manaivi,* taking along something.

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[7] This can be no other than the island of Samasana, 46 miles north of Botel Tobago.

bote, as du katalamad namen sira du avăng am uyud a rakúx u kamu namen anu pisarasarayan da sira, du kadyí namen pa a makapanmuan su pariñen da. As du kapitadyorong darana am mian u ranúm kanu kapapanmu darana nu kapia da tao.

22. Nu avăng am navidin a maybebera as nañieng a mirua a gumchin u bote a pinachisakayan ku kanu mayhahaw a tadyiranuman namen, as du kairaya namen daná am nañieng a machivayat dyiamen u cabecilla nu maytataaw as kavata na su kapachisakăy cho dia a makaraya as du kayán namen daná du iraya kanu bote am navuya da nu tao auri u karu nu tadyiranuman a ipuranum namen, a puranuman da nauri atavu as kangay da ñia du bote kanu angu pa sira a

boat; and upon our observing (this) we in the ship had a really great fear that they might be hurt by them, as we did not know their actions. But when they returned, there was water and they made us know the goodness of the people.

22. The ship kept veering about on the same place and at once the boat went down again, I embarking in it with a few of our water vessels, and when we came near the shore, there at once came to meet us the headman of the fishermen and he bade me embark with him to go to the shore and when we were at the shore and (with us) the (ship's) boat, those people saw the number of vessels to be filled by us with water, and they were all filled by them and brought to the boat,

mayhahaw, what is reduced in number.
mitataaw, fisherman; cf. *taaw* under 2.
hahawen, what is believed or opined.
yanan, place in which something or somebody is; cf. *kaiyan* under 16.
cabecilla (Span.), headman, foreman.
chinawagan (Basco: *tinawagan*), what has been called.
konó, it is said.
masesngen, what approaches; cf. *kasngen* under 3.
machivayat, who goes to encounter somebody.
pisarasarayan, who is hurt by somebody.
makapanmuan; cf. *mapanmu* under 3.
kapitadyorong, time of returning (to a place).
22. *navidin*, perf. of *mavidin*, remaining in a place: *Dios mavidin diño!* God abide with you! the salute on parting in the Batanes.
maybebera; cf. *kapaibira* under 8.
tadyiranuman, water vessel, a term apparently peculiar to the town of Mahatau.
kavata na su kapachisakay cho dia, lit. "his say (was) my joinedly riding in regard to him."

mavuya da a ichahoho namen am iangay da a chitahen as kangay da ñia du bote, vinachi kanu rakanen a kanen nu bagu.

23. Nu cabecilla nu mitataaw am naparutung nu kanin namen du vahay na uri, asa ka kawa a kulay a wakay, as kavata na sia du muestra dyiaken u kakan namen sia atavu a makasakasakayan, as kapirua na rana kañira u rarayay na uri a tumapang du kapangamong da. Navidin namen pa a katnayan u karaw namen du yavayava na uri ñiamen, as du nakatayuka namen a umaraw a navidin ako du iraya a namanda du nakakavus da a mavuavuhud a kuman as makuyab da-

and whatever else they saw to be our desire, they went and searched and brought it to the boat: firewood and green forage for the pigs (on board).

23. The headman of the fishermen caused food for us to be boiled in his house: a large iron kettle (full) of dried sweet potatoes, and he told me by signs this to be the food for all of us shipmates; and he with his companions again went on fishing. We stayed yet awaiting that (midday) meal from his hospitality for us; and when we had finished eating I remained on shore until they (all) had finished eating in turns, and it was already well into the afternoon when I

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karu, from *aru* or *arru,* many.

kangay, from *angay,* idea of going and also of bringing.

vinachi (Basco: *vinati*), firewood; *mamati,* go for firewood; *vatien,* what is made into or used for firewood; another term is *irotong,* instrument for *rotong;* that is, cooking.

rakanen, green food, vegetables; *manakan,* who cooks such.

bagu, also *bagu a kuis,* pig. The panco carried a cargo of live pigs.

23. *naparutung,* compare radical *rotong* under *vinachi* above.

kawa, a large, panlike kettle of cast iron known under this name all over Luzon, etc. Fabro underlines the word in his MS., perhaps because he felt it as a loan word from the mainland Luzon.

kulay a wakay; by *makulay* are designated in the Batanes sweet potatoes cut in slices and sun-dried; also sun-dried fish; *wakay* is *Ipomoea batatas* in different varieties: *bayat, china, gabotero, lina, darbong, ballada,* etc.

muestra (Span.), sign, token, sample.

tumapang; radical *tapang,* idea of continuing.

katnayan; radical *naya,* idea of waiting; *Angu katnayan mo?* What are you waiting for? *Dicho a panaya,* I have no time to wait.

karaw, midday meal; *umaraw,* eating the midday meal.

yavayava, hospitality, kindness to visitors. Possibly glottal check after last *a.*

nakakavus; radical *kavus,* idea of finishing something completely.

mavuavuhud, who alternates; more common form: *mavuhuvuhud.*

ná am sumakáy aku du avång as kakaru namen daná a mangay du Formusa, as mian kami du asa du rakúx a vaha na du kumaidauran am mawará u mapalispis a idaud as pirua namen a mayvidi as kapamatán namen daná.

went aboard the ship and we set out going in direction of Formosa, and we found ourselves at one of the great promontories of the northern part when there came a squall from the north and we went back again and made for the Batanes.

24. Du kapirua namen daná a mayvidi am a las 10 p. m., as a las 2 a. m. am masinmo namen u Yami, as misexsexdang am arapava u mavuya namen a tana; as a las 7 a. m. am masari du kayukayaman su naychihat a dinamen a natanggal.

24. When we were (thus) going back again it was 10 p. m. and at 2 a. m. Iami was in front of us, and at daybreak we saw no more land; and at 7 a. m. it had become dark in the northeast quite suddenly without our being prepared for it.

ICHAPITO A KA ARAW

THE SEVENTH DAY

25. Du nakaparanis na sia dyiamen am dichamipa a makapangariso, as nu mastelero du mayor kanu trenquite am naychamamchi du pangorsitan; du

25. When it struck us, we had not yet been able to reef the sails and the main and fore topmasts were about to burst . . . (du pangorsitan) ; when it was

vaha, rocky point, promontory.

kumaidauran, (more commonly: *kaidauran*) northern region, radical *idaud,* north, north wind. Infix *-um-* appears to add to the comprehensive force of *ka-an* a certain amount of motion: "all that enters into the idea of north."

mapalispis, said of the wind coming on with a striking force: squally.

kapamatán, radical *vatán,* Batán; *mamatán kami,* we are going to the Batanes; *pamatán ku niaya,* this is what I take with me to the Batanes.

24. *masinmo,* what is in front; cf. *sinmu* under 9.

arapava, from *ara pa ava,* there is more not.

masari, what is dark.

kayukayaman, radical *ayukayam* q. v. under 1.

naychihat, cf. *minaychihat* under 1.

dinamen, not our.

25. *nakaparanis,* cf. *rumanis* under 9. The meaning of radical *ranis* seems to be immediateness of action without anything intervening.

dichamipa, di, not, *chami* (*kami*) we, *pa,* yet.

makapangariso, possibly built on the Span. *rizo,* reef.

katayuka na naori am nañieng namen a hunen a dyi a nangay du lugár na as naybabat. Nu trenquite am navudintád a machitalin du butalón u berga a muvvu na a pasayapen u vidad a ipuha.

over [that is, the squall], we at once rolled up (the sail) which was not in its place and athwart. As to the foresail, the yard was turned over upside down by the side of the bowsprit and the sail was nearly blown out and carried away.

26. Du karahan nu chubasco am pisunungen namen du lugár na u vidad as kahoon namen su trenquite, am navuya ko sira daw u kaduan du grumete a maypuha nu tavatavayay sira ori, am vatán ku sia u kadyida a michawawan as ipuha dava u tavatavayay sira ori, am vatán da sia: "Michawaw kami ava as iturux namen a payawatan nu gumintos asa du kasakáy ta," as axsan ko ñia anu sinu u ngaran na am pinapanmo da dyiaken u ngaran na a si Gelasio Abas; ya am pinalsi nu vidad.

26. The squall past, we put the sail into its proper place and when we were rolling up the foresail, I saw some sailors throwing calabashes (overboard), and I told them not to make any mistake and not to throw away those calabashes, and they answered: "We are making no mistake for we give these as means by which to keep afloat to one of our shipmates who has fallen (overboard)", and I asked them as to what his name was, and they told me his name was Gelasio Abas; he was pushed (overboard) by the sail.

mastelero, topmast; *mayor*, main; *trinquete*, foremast, foresail; all Spanish nautical terms, the last being transformed into "*trenquite*."
naychamamchi, what is cracking or about to burst.
pangorsitan, I believe this to mean "halyard."
hunen or *hoonen*, object of rolling up.
lugár (Span.), place.
navudintád, turned the wrong way; cf. Tag. *baligtád*, same meaning.
butalón, Span. *botalón*, bowsprit; *berga*, Span. *verga*, yard.
muvvu na; the sense is that of almost, nearly.
pasayapen, radical *sayap*, idea of flying.
ipuha, radical *puha*, idea of throwing away.
26. *karahan*, cf. *nakarahan* under 16.
chubasco (Span.), squall, rain shower.
pisunungen (or: *paisunungen*); radical *sunung; masunung*, what is straight or perpendicular; *pasunungen*, objects to be placed in order.

27. Si changuriaw am maparin tava a iangay ahapin am amanda du katayuka ta a umnamunamu su naputot aya anayasan ta maparin tava a pagchinen u bote as nu pinarin ku am inaguhunan ku u lugár a yanan nu gumintos aori a tau, as kapakalukalu ku nu kanamunamu su trabaho aori a namanda du kaparin na a tairan su bote a pagchinen.

27. At that very moment we could not go to pick him up, but only after our having finished fixing up the broken mast, for we could not lower the boat; so, what I did was to fix by the needle the place where that man who had fallen (overboard) found himself and I hastened the cleaning up of that work until the boat could be lifted up for being lowered (overboard).

28. Du katayuka na naori a trabahuan am nañing a pagchinen u bote am uyud a masadít du kapahong na kanu kasalawsaw na pa, as nu kapuspús namen dyia su panda nu

28. Upon the conclusion of that work we lowered the boat at once and (this was) very difficult on account of the waves and also of the wind, but the effort we made to the limit of

tavatavayay, a certain variety of *tavayay;* that is, large calabashes that serve in the Batanes as receptacles, especially for carrying water.

michawawan, radical *awaw*, idea of erring, mistaking.

iturux, what is given; cf. *katurux* under 13.

payawatan, term applied to anything that serves to keep a man afloat in the water, such as a board, the trunk of a banana, etc.; radical probably *awat*.

axsan; cf. *kahes* under 12. *Aravay panahexsan ko*, there is nobody whom I might ask.

pinapanmo; cf. *mapanmu* under 3.

pinalsi, perf. of *palsien*, object of pushing.

27. *si changuriaw* (or: *si changu yaya*), an intensive form of *si changuri* (or: *si changu ya*), which latter means: now.

tava, from *ta*, we, and *ava*, not.

ahapin (or: *ahapen*), radical *ahap*, idea of seizing, catching.

umnamunamu, who repairs, cleans; *manamunamu*, what is clean.

naputot, perf. of *maputot*, what breaks (intr.); cf. *mamutut*, who breaks (trans.)

anayasan, mast.

inagúhunan, evidently built on radical Span. *agujon*, big needle (here: of the compass).

trabaho, Span. *trabajo*, work.

tairan (also: *tairen*), what is lifted with the help of ropes; radical *taid; manaid*, who lifts.

maparin namen du kasi namen nu tau aori a mavidin a mayaguanta a miay su karakuhan na du panda nu maparin na, as agchin nu manaub a mangaud kanu asa ka timonél a chinuruhan ku nu aguhon a pinapanmuan ku nu rumbo da as minangay sira a mauhamek su kavuya sia, abú su naparin dyira a namanda du nakapaitadyorong da du aváng.

our strength (was) on account of our compassion for that man who was left struggling to save himself with the utmost of his strength, and there went down (into the boat) sufficient oarsmen and one helmsman to whom I gave the compass on which I showed him their course, and they went and found him easily, nothing happening to them until they managed to return to the ship.

29. Ya am suminakáy du avàng a uyud a mapáw su kachichiban as kanañieng na umuyog nu hoo na makayamot du kasaray a minalibre du rakúx a pinannganngan na.

29. He came on board the ship very dejected in appearance and suddenly his tears were flowing with joy at having been freed from his past great danger.

30. Du nakarahan na naori am pinasakáy namen daná u

30. After this we hoisted our boat on board and turned to

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28. *kapahong;* radical *pahong,* wave.
   kapuspús; radical *puspús,* idea of exertion, valor; an old term for the supreme headman on the island of Batán was *mangpús.*
   panda, limit.
   mayaguanta; radical Span. *aguantar,* to hold out.
   miay su karakuhan; karakuhan, body; radical *rakúx,* large, big; *miay* has the sense of "to protect, to save (one's life)."
   agchin; cf. *pagchinen* under 2, *gumchin* under 20.
   manaub; cf. *kanaub* under 6.
   timonél, Span. for helmsman; *rumbo,* Span. for course.
   minangay, apparently, beside *nangay,* a perf. of *mangay,* q. v. under 1.
   nakapaitadyorong; cf. *kapitadyorong* under 21, where *pi* might be contracted from *pai.*
29. *mapáw;* cf. *kapáw* under 10.
   kachichiban, appearance; cf. *kachidib* under 11.
   umuyog; radical *uyog* (*uyug*), idea of flowing of water.
   hoo (*huu*), tear; *mihuhuu,* who sheds tears.
   kasaray, joy, happiness.
   minalibre; radical Span. *libre,* free.
   pinannganngan (pi-nan-ngan-ngan); radical *nganngan,* idea of bodily danger.

bote namen aori, as kapirua namen a umnamunamu su kaduan pa a nararayaw, as kapirua namen daná a tumapang du kapamidad namen a mamatán a namanda du nakapakarapit namen du vanwa du Mahatau aya; abú daná su miñirua a pannganngan namen.

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repair some more damages, whereupon we continued again sailing for the Batanes until we reached the bay of Mahatau here without any further perils for us.

THE END

30. *nararayaw,* perf. of *mararayaw,* what is in disorder; radical *rayaw,* idea of disorder.
tumapang; see under 23.
kapamidad; radical *vidad,* sail.
mamatán; radical Batán; cf. *kapamatán* under 23.
vanwa, bay, landing place.
Mahatau, township on Batán; radical *hataw,* idea of floating on the water.
tausan; radical *taus,* idea of conclusion; syn. *kavusan,* from *kavus.*

LADYI A NANUMA

FIRST SONG

[For a better appreciation of the conditions under which songs like this and the following ones spring into life, a brief description was given at the beginning of this paper of the natural phenomena as well as of the economic and social life that characterize the Batanes. With an idyllic scenery inciting the minds of the islanders to poetic imagery, and pitiless storms decimating their families and destroying their fields, the keynotes of their songs can hardly be other than those to be heard from the selection of poetic prose here given. The following songs are somewhat literally translated, and it is left to the footnotes to do justice, as far as possible, to the literal sense of the words. At the end of each song a short explanation of its general tendency is found, while several details must necessarily remain obscure for reasons given in the introduction.]

Duvo a valayvayan du mayapitukunan pachidalawsawan nu tuminuduk nu muyvux a hahakawan!—Ipakaima kuava nu maduyusubit su pawpaw a binahachitan nguri am ipakaima ko u madiyasirap su pinanaudi a wakay ta su ahawen a di-

Oh beneficial valayvayan tree, resort of those who wish to refresh themselves with the fragrant breeze from the hills! Prize of my sole place of husbandry!—I appreciate not him whose only work is to angle at night for fishes to be dried in the sun; I esteem him who

mayavake nu vudik da nu kamanganakan. Anu kapaduduhad nu araw a umusuk umudi a mangates du niyapuan a maydoloken a mavaheng ta panalaway mo su komniay a kawalo du rapán nu dima mo. Anguhen a ivosuy su pagalitidieten ta mayango anu domibu ka du piratayan a umaliyalid nu mintid a kuminavus a pinitduan a kaunasan a pichaludisuditan nu hapa nu inulut a biyedbed nu rapung nu unas. Angu ichakaduyo mo! Du dimayunas a dumaray niya u kapangunut mo du tudung nu kaydian?

owns conterminous fields planted with the late sweet potato, for his children will likely not go hungry. When the sun is low in the sky, return from the field and proceed yet to the sugar mill to crush cane, and with the juice fill one of the large pots the sale of which will fill the palm of your hand with shining silverlings. What is the use of loud protestations of love? It were better you went to work in the field on the plain, attending to each single stalk of the sugar cane that has been completely bundled together for the third time with its drooping leaves that will serve to tie the bundles into a rapung. What laziness is yours! Being without sugar cane, do you expect to go after palek as a gift from a townsman?

duvo, in songs for *tuvo,* growth, utility, profit.
valayvayan, one of the species of trees planted to fence in fields.
mayapitukunan; radical *tukun,* hill; *pitukunan,* hilly region; prefix *maya-* often denotes: "smelling of," as in *mayaamong,* having a fishy smell.
pachidalawsawan; radical *salawsaw,* wind; *s* often changed to *d* in singing.
tuminuduk, what has become the prize, reward, or remuneration.
hahakawan, from radical *hakaw,* idea of working in the field.
maduyusubit, spending all the time in fishing.
binahachitan, what has been fished with the angle at night.
madiyasirap, what is contiguous.
pinanaudi, what has been planted at a late time.
wakay, Ipomoea batatas.
ahawen; cf. *ahahawen* under 7 in Voyage of the panko San Carlos.
dimayavake, not lacking contents; *vudik,* the belly.
kapaduduhad nu araw, position of the sun near the horizon either in the morning or in the afternoon
umusuk, what descends on an inclined plane.

umudi, who returns from the field to the town.

mangates, who crushes sugar cane; radical *ates; atsen*, the object.

niyapuan, vessel, container.

maydoloken, for *maysoloken*, an old expression used in counting money and meaning "what exceeds one peso;" *dua a soloken* is "two more than one peso," by *dua* being understood *dua a vinukœx;* that is, two half reals (of 6¼ centavos each). Synonymous with *vinukœx* is *kawalo;* that is, the eighth part of one *buhawan* (50 centavos).

mavaheng, black; also: a large earthenware pot of that color.

panalaway, what is held in the hand.

komniay a kawalo; komniay, shine, glitter; *kawalo*, see above *maydoloken*.

rapán, the palm (*nu tanoro*, of the hand) or the sole (*nu kokod*, of the foot); *dima* for hand is seldom used.

anguhen, often shortened to *angen*, what for? from *angu*, what?

ivosuy, what is told, proclaimed.

pagalitidieten, what gives a loud or queer sound.

domibu, for *somibu*, who starts out to work in the field.

piratayan, level lands; *ratay*, plain.

umaliyalid, observing and attending with care.

kuminavus, perf. of *kumavus*, what becomes complete.

pinitduan; as the height of the stalks increases, they are tied together three times in succession, being thus called *pinisaan*, once tied, *piniduaan*, twice tied, and *pinitduan*, thrice tied, respectively.

kaunasan, sugar-cane field, from *unas*, sugar cane.

pichaludisuditan, same as *paychaludyiludyitan*, what is hanging or suspended.

hapa, green or dry leaves, and especially the stems of leaves; a more general term is *vuhung;* leaves used for plates: *daun;* fallen leaves: *inhay;* leaves of *Piper betel*: *samux*; still other terms in use.

inulut, binding material, such as vines, rattan, etc.; radical *ulut*, idea of pulling a wire, vine, and the like from some obstruction, or tangle.

rapung, about four bundles of sugar cane tied together by their crowns.

ichakaduyo, laziness; synonym: *ichatalakak*.

dimayunas, one without field of sugar cane.

dumaray, for *sumaray*, one awaiting or expecting.

kapangunut, the act of going after.

tudung, what is offered to those who take part in a work of neighborly help, such as thatching a house; generally *palek*.

kaydian (*kaidian*), townsman, from *idi* (*ili*), town, village.

The preceding song is in the way of an answer given by a girl to a young man aspiring to her hand. After an apostrophe to the field that forms her sole possession and on whose beautiful surroundings she apparently has set her heart, she turns to her suitor giving him to understand that she lays more weight upon assiduous work in the field, the only guaranty for the welfare of a family, than on wordy protestations of love. The language certainly lacks nothing in clarity of purport, though the mention of much time spent in angling at night might possibly involve a covered allusion to conduct on the part of her suitor little in harmony with his professions of love. We have here testimony for the soundness of ideals to be found among Batanese womenfolk, ideals taught them by the hardships of their life.

LADYI ICHADUA NA

SECOND SONG

Anu kapaypahabas nu adipasayaw du teyedted nu vahay nio kani ama mo am tawyen mo sira nu tatawi a talugun nu niyoy ta manumanuk sira ni apu ta du tuab nu vahay. Vuhawan du balugan, vuhawan du kadpidan, mirua ka du adán mo a katachiran ta sayangen ka nu sinukulan a palek a yapu du yawran a takey.

When the little birds adipasayaw pass under the eaves of your and your father's house, regale them (with palek) using as cup the half of the tiny coconut shell called talugun, for they are the birds of our Lord over the gables. Gold of the Orient, gold of the Occident, return to your former dwelling place and you will be treated with the well-seasoned palek of dark red color that proceeds from the fertile fields called yawran.

kapaypahabas, the act of passing.

adipasayaw, a kind of migratory birds passing the Batanes at certain seasons and staying only for a couple of months.

teyedted, space on the outside of a house comprised between the eaves, called *riyan*, and the ground.

tawyen; the original meaning would seem to be "palek to be poured into a coconut bowl (*tatawi*)," hence "the person, the guest, who is thereby to be regaled."

talugun, a variety of *Cocos nucifera* with very small nuts.

niyoy (*nioy*), *Cocos nucifera.*

tuab, the gable ends of the roof of the house (*vahay*); an old native suggested my translating "*apu ta du tuab*" directly as "our Lord God."

vuhawan (gold) *du balugan, v. du kadpidan; kadpidan* was stated to apply to the side of the island facing west, while *balugan* has the meaning of "the other, the opposite side of the island" where the sun rises; *ibalugan* are called on Batán those who live on the eastern side of the island, opposite to Basco which is on the west coast. Cf. Ilk. *baliu*, the opposite side of a river or of the sea. The evident stem of *kadpidan*, viz. *adpid*, has the meaning of putting something heavy on something else, so as to secure it.

adán, better *adaan*, old, former (said of objects).

sayangen; interpreted by some as meaning "object of sacrifice," it being understood that the sacrifice involves the shedding of the blood of a living being, such as a domestic animal, so that its blood may ensure the safety, say, of a new house or bridge, etc.; others translated the word directly with "object of moistening," a sense which, in connection with the blood red color of the special palek in question, leads back to the idea of a sacrificial act, little as this can be reconciled with the general purport of the song.

sinukulan a palek is palek that has been kept for a long time, perhaps even for years, in an earthenware pot that is sometimes buried in the ground, the liquid thus acquiring with age a dark red color; it is reserved for special occasions, such as the arrival of distinguished visitors.

yawran a takey; the general term for field, *takey,* specialized by *yawran,* which takes also the form *diuran,* meaning "place of fertile soil;" *Diuran,* proper name of certain fields near Basco.

This *ladyi a pinasinmo,* or significative song, was explained to be addressed by a young man of wealth and good family to a girl of like social position, asking her to receive him well when he goes to her house, and promising her that, if she would consent to marry him, she would be treated well as being of his own rank. As stated before, it is difficult clearly to trace the meaning of this kind of ancient songs through the words of the text.

LADYI A ICHATDU NA

THIRD SONG

Anu minamalugan ako as
mangadpidan a komita su pi-
danuyan nu vanwa am dicho
a dali ta mayabayabatuy sira
u manayrin du naho matbung
ava nu vinhuk a ganaysiwan
ka si dahudù nu dimhés a uma-
dimpurung di maidak a sungu.

Whether I direct myself to the coast over which the sun rises, or turn to the opposite shore, searching for a bay of placid waters, I fail to find it for the fishermen in the open take up their position in a line according to chosen landmarks and do not drop their small hooks destined for the (fish called) taysiw for the (one called) dahudú which is unceasingly pursued by the white sungu.

minamalugan and *mangadpidan;* cf. note to *vuhawan* under second song.

komita (*kumita*), *manita* or *manta,* who searches, looks for something; radical *chita* (Tag., etc., *kita*), sight.

pidanuyan, same as *katanuyan,* said of quiet unruffled waters; radical *tanuy,* smooth, gentle, placid.

mayabayabatuy, a poetical form of *mabatubatuy,* what is arranged or placed in a line; radical *batuy* (*vatuy*), idea of line, row.

naho, syn. *tuvidan,* what is used in an effort not to lose from memory; here: landmarks used by fishermen to give them the bearings of spots frequented by certain fishes; *naho* has besides the meaning of "man of trust," *tao a kasarayan.*

matbung, who drops something into the water.

vinhuk (syn. *inihuk, pinaysayran*), what has been bent or curved into a hook.

ganaysiwan, poetical for *panaysiwan,* a certain kind of fish hook used for catching the *taysiw,* from which it takes its name.
dahudú, name of a fish; said to denote also a poor man, a peasant.
dimhés, from *di umhés* (equal to *umhés ava*), not cease; radical *abhés,* idea of ceasing.
umadipurong, who follows, goes after.
di maidak a sungu; di evidently for *du; maidak a sungu,* white (really white spotted) fish *sungu.*

In spite of all efforts made, an exact interpretation of the details of this "significative" song could not be secured; it was stated to be meant as giving the position of a lover who is foiled in his intentions toward a girl by her being constantly followed by a rival.

LADYI A ICHAPAT NA

FOURTH SONG

Manlasal i hoo ko a dumañis ta padayapen ko si dadua a ka mata ko. Kumavus daná sira a makatining daná as makativaw dana du nuhud nu tukón, u minadkel a kadaisa ko, manga gayñapuan atavu. Anu inalialit na pakunó yatin ni Apu ta si Dios du kapaydayatao na diatin! Makasiasi dan ay i dumindang a hupes! Takunó i vutox nu adan a kalirang! Diako a mayatuhos a viltinen nu umudi as kulturen nu kumatuvo; mana akmay yaken u misinayaw a chinanan du nohos nu rarahan a pachidirungan nu minasbang du ama kanu ina.

My tears are falling with weeping as I raise my eyes. They all have been able to get on (in life) and have already reached the top of the mountain, my relatives of my own generation; all of them are as seniors to me. Would that our Lord God had made equal our destiny when he created us men! How pitiable is it to be the only blind grain among the seed! Look at the old kalirang vine! I am unable to make shoots as I am tugged by the people returning from the field and plucked by those going out to the field. I am like a leaf that has been used as a plate in eating and is cast into the middle of the road, the shelter of those bereft of father and mother.

manlasal, what falls like tears, grains, powder, etc.
i appears in songs as an alternative of article *u.*
dumañis, for tumañis, radical *tañis,* weep.
padayapen (for *pasayapen*) *si mata,* raise the eye; note *si* for *su.*
makatining, who is able to pass on.
makativaw, who is able to ascend.

nuhud no tukón, top of the mountain.

minadkel a kadaisa (rectius: *kataisa*), clan of cousins.

gayñapuan atavu elders (ancestors, seniors, superiors) all; *manga* is the Tagalog pluralizing particle which, as some other Tagalog words, occasionally creeps into Batán.

inalialit, perf. of *alialiten,* what is made equal.

pakunó, term interpreted by some as "lot, fortune;" others give it as an expletive substituting another term not just remembered. Cf. Tag. *kuán.*

dumindang, for *sumindang,* what finds itself of a different kind among others of one kind.

hupes, blind grains of seed, blind nuts.

takunó, idiomatic for "look here:" *takunó iya,* look at this; evidently related to *pakunó* above; cf. "Viahe nu panko," sec. 21: *konó.*

vutox, kernel of a fruit; cf. Tag. *butil.*

kalirang, a vine found around Basco creeping up, and hanging down from, trees growing at the roadside, a handy binding material to passers-by; the *inulut* in the First Song; leaves eaten as a vegetable.

mayatuhos, what sends forth shoots.

viltinen (radical *viltin*), object of pulling with a jerk.

umudi, see this under First Song.

kulturen (radical *kultud*), object of plucking.

kumatuvo, who goes from the village to work in the fields.

mana, a particle inserted between clauses to indicate progress of the discourse; according to context: "and, then, but, now," etc.

misinayaw, what is thrown away; radical *sayaw;* cf. *sumayaw,* said of the wind carrying away something.

chinanan (radical *kanan,* root *kan*), what was place of eating; at large gatherings food is often placed before guests on large leaves serving as plates.

nohos nu rarahan, middle of the road.

pachidirungan, for *pachisirungan;* cf. *kasirungan* (radical *sirung*) place sheltered against sun, rain, etc.

minasbang, or *nasbang,* orphan; *michasbasbang,* who becomes orphan; radical *asbang.*

The preceding bitter lamentation over an ungrateful fate, sung by a poor female relative at some family gathering, is evidently meant to move the hearts of her better-situated cousins to grant her relief. It is original with the singer, and probably an improvisation. As stated before, everybody present at the gathering is expected to contribute a song, wherefore each singer closes his song with such words as these: "*Ahap as ralaw padaw, mo lipos, ta su dimayhanis nia,*" meaning "Take up the song, you my cousin (or relative), so as not to give an unsatisfactory result."

KALUSAN

CHORUS OF ROWERS

Hesma hiawaway!	Bear a hand, boys!
Raunen ta u layag!	Launch the boat!
Ixbét du huvék	Passing out of the bay
Hawahawayen	We shall test you
Du mayavaha na	Off the point,
Imo, mo layag	You, little boat,
A mapsek a kayo.	Prudent timber.
Payhiñoré	From now on
Tadichokorí	Leave behind you
U vanwa mo	Your port
Pa vinohoré	And pass over

hesma hiawaway, two words of exclamation stated to be meant to inspirit the boat's crew for greater exertion. The words of this, as of all following lines, are, in chanting, either contracted or disrupted, their syllables lengthened or shortened, stressed or slurred over, so as to make them fit into the rhythm of the movements of the rowers which they accompany and accentuate. They become thereby to the greater part unintelligible.

raunen ta u layag, interpreted by some as "we make sail on the boat" cf. *daun,* leaf used as plate; *vidad,* sail; Tag. *layag,* sail); others point out *raunen* as an old expression for "launching a boat" and *layag,* repeatedly used farther on, as clearly meaning "boat." The radical *raun* occurs again, near the end, in *karaun* with the meaning of "discharge." The modern term for what is discharged or brought forth from an inclosed space is *aunen.*

ixbét du huvék; cf. *muxbét* (radical *axbét*), what goes out, issues; *huvék,* bay.

hawahawayen (radical *haway*), what is object of testing.

mayavaha; vaha, point, promontory.

imo, mo layag, lit. "you, you boat;" for the appealing repetition of the pronoun compare: *machiahuahuk kami dimo, mo Apu Dios,* freely translated: we beseech you, dear Lord God.

payhiñoré, radical *iñiod,* idea of lastingness; cf. *maiñiod ka a marahet,* you are bad all the time; the addition of an inorganic final *é* (*í*) is evidently meant to give more vigor to the corresponding jerky movement of the rowers.

tadichokorí, for *tadichokód,* turning of the back (*dichód,* Tag. *likód*) final *i* is inorganic, as above.

vinohoré; radical *vohód,* idea of passing over temporarily, borrowing; inorganic final *é,* as above.

Asa du vanwa mo	To your other landing
Du nachilubang aya	On the opposite side,
Daan mo a kaiwamán.	Your old familiar place.
Imo, mo layag,	You, little boat,
Hamuan mo ava	Do not desist
A di puspusan	From your endeavor
Si tinalalan.	To reach the destination.
Ibhés mo ava	Do not cease
Sapasapahen	To look for
si mambré nu isaak	The swift flow of the tide
Iyalakuíd	To go with you
Maasek du iraya	Towards the land
A vuyan ta sia	Where we shall find
Si madmay a huvék	That beautiful bay,
Punduan ta nia	The place to anchor
Mayor nu sadyit	With our best anchor,
Karaun ta diá	There to discharge
Chinarga nu layag	What the boat has loaded,
Ta rexdaimio	For they are awaiting you
Pachimabayagan	Impatiently,
Nu naypuyepenged	Everyone of those
Minapalibo.	Whom we left behind.

asa du vanwa, to the other port; *asa* (*isá*), one, often used in Philippine languages to mean "the other one," possibly due to its originally demonstrative character.

kaiwaman, radical *iwam;* cf. *maiwam,* who is accustomed.

hamuan, radical *hamu;* cf. *umhamu,* one desisting.

puspusan, what is strenuously endeavored.

tinalalan; radical *tala,* idea of prearranging.

ibhés, what is discontinued, perf. *binhes; umhes,* who discontinues.

sapasapahen, what is looked for; perf. *sinapasapa.*

si mambré nu isaak (*isāk*); *si* for *su; mambré,* old word for present *mamlí,* the strong, swift flowing of currents; *isaak,* cf. *ries,* under sec. 5 of Viahe nu panko San Carlos.

punduan, probably from Span. *fondear,* to anchor.

mayor (Span.), greater, greatest; *sadyit,* anchor.

karaun, cf. *raunen* above.

chinarga, a perfect obtained with infix *-in-* from Span. *carga,* load.

ta rexdaimio was translated "because (*ta*) awaiting you;" second word obscure, possibly containing *dimo* or *dinio,* prepositional cases of *imo, inio,* thou, you; the presence of *taruk da,* their signpost, might be considered.

pachimabayagan, cf. *mavayag,* tardy.

napuyepenged; for radical *penged* compare: *maypenged u ngaran nu takey,* each field has its name; *siraya a tatdo a ka personas am michakapenged dira u ka Dios,* those three persons are, each one for himself, God.

minapalibo, translated with "who or what has been left behind."

The preceding song, which contains a number of old words and old forms of words, now found only in songs and difficult correctly to interpret, expresses a pretty train of thought in a way that bears witness to the poetical disposition of the islanders. It was sung by the men who rowed me and my company in an open boat (called *chinerkeran*) on my return from Itbayat to Batán, some twenty miles over the high sea, a trip which makes the question of reaching Batán with the help of the current one of life or death. The same boat had less good luck on its following trip over the same route in January, 1909, when President Naqueta of Itbayat, with a number of other notables, bent on a return of my visit, were buried in the waves which only cast ashore a mast with torn sail and a water-logged trunk found among the cliffs of northern Batán.

ADDITIONAL REMARKS ON PHILIPPINE GYRINIDÆ

By GEORG OCHS

Of Frankfurt am Main, Germany

Since I published my work on the Philippine Gyrinidæ,[1] I received still further material from the Philippines through the kindness of Prof. C. F. Baker, of Los Baños. The study of this material resulted in the records given here and the discovery of another new species of *Orectochilus,* the description of which is also given here.

Orectochilus oberthüri Régimbart.

LUZON, Benguet Subprovince, Baguio (*Baker*).

Orectochilus pulchellus Régimbart.

SAMAR (*Baker*).

Orectochilus discus Aubé.

SAMAR (*Baker*).

The singular formations mentioned in my last paper in relation to some specimens of this species from Mount Maquiling have now been recognized as belonging to the Laboulbeniaceæ, which are frequently found on gyrinid beetles.

Orectochilus samarensis sp. nov., male.

Long. 5 mm. Ovatus, parum elongatus, valde convexus, postice leviter attenuatus. Supra cupreo-aeneus, fortiter reticulatus (areolis rotundatis), ad latera punctato-tomentosus (pubescentia aurea), margine flavo. Infra piceo-ferrugineus, abdomine pedibusque rufescentibus, epipleuris flavis. Labro rufo, semicirculari, producto, postice nigrescente atque punctato-piloso, antice glabro et pilis longis flavescentibus instructo. Margine tomentoso in pronoto parum lato, postice paulo latiore, post oculos angustissime valde intus dilatato; in elytris latiore, valde ante medium semicirculariter et convexiter intus dilatato, suturam oblique circiter ad medium attingente; spatio nudo brevi subcordiformi, postice constricto et ad suturam late triangulari postea producto. Truncatura obliqua, paululum subsinuata, angulo externo obtuso sed distincto, suturali recto. Tibiis anticis elongatis, subparallelis, ad basin attenuatis, angulo apicali externo denticulato, parum producto sed rotundato, tarso sat lato, elongato-ovali.

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[1] Philip. Journ. Sci. 24 (1924) 81–86.

Type, male, in my collection, from Samar (*Baker*).

Somewhat similar to *Orectochilus discus* Aubé, but easily to be distinguished from this and all other Philippine species of this genus by the very produced red labrum and the characteristic outline of the denudate portion of the elytra, which is shortly heart-shaped with rather sharp angles at the beginning of the posterior constriction, which is rather regularly triangular. The surface is of a coppery metallic hue and minutely but very distinctly alutaceous.

There is much affinity in characters with *Orectochilus vitalisi* Peschet[2] from Laos, which is probably the next allied species hitherto known. The female of *Orectochilus samarensis* is yet to be discovered, and will probably show some differences, especially in the outline of the denudate portion of the elytra.

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[2] Opusc. Inst. Scient. Saigon 1 (1923) 14.

A CATALOGUE OF PHILIPPINE CARABIDÆ

By H. E. Andrewes
Of London, England

When G. A. Baer published his Catalogue de Coléoptères des îles Philippines [1] he enumerated thirty-six species and varieties of Carabidæ. Of these I have had to eliminate three, namely:

Pheropsophus ambiguus Dejean (= *occipitalis* MacLeay), never decisively recorded from the Philippines, though it may occur in the southern islands, as it is undoubtedly found in Borneo.
Scarites mancus Bouchard (= *idus* Olivier), a species which I believe to be confined to India and Ceylon.
Simodontus picescens Chaudoir, almost certainly an Australian species.

There remain thirty-three species and varieties known in 1886 as inhabiting the Philippine Islands. Up to the early part of 1926 a further seventy-three had been described or recorded, making one hundred six; to these I am adding, from my records of the numerous collections which have passed through my hands during the past ten years, a further forty-nine, making in all one hundred fifty-five species and varieties. These fresh additions are due in large measure to the energy of Dr. C. F. Baker, who has discovered many species new to the local fauna, fixed the exact localities in which others have been found, and collected much new material, most of which still remains to be dealt with. I have seen examples of nearly all the species enumerated, and have also had the opportunity of examining the types of most of them.

The arrangement in this paper of both genera and species is alphabetical, and at the end will be found indexes of both the synonymous and the subordinate genera, and of the species; in the case of genera the original spelling has been adopted. Only original references to both genera and species are given, and only Philippine localities are inserted, the latter being as full as possible; for further particulars my General Catalogue of Oriental Carabidæ, now in course of preparation, may be consulted, where full references and an extended list of localities will be found. Synonyms, both of genera and of species, are printed in italics after the references, though in the case of the former they are not always the exact equivalent of the genus after which they are placed.

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[1] Ann. Soc. Ent. France (1886) 97–200.

The meanings of the signs used are as follows:

* = The species is recorded here for the first time.
‖ = A preoccupied name.
† = The species quoted is other than that described by me.

ACUPALPUS LATREILLE, in Cuvier's Reg. Anim. ed. 2 4 (April, 1829) 391.
  annamensis BATES,* Ann. Soc. Ent. France (1889) 272.
    LUZON, Laguna Province, Los Baños; Mount Maquiling.

AEPHNIDIUS MACLEAY, Ann. jav. (1825) 23.
  adelioides MACLEAY,* Ann. jav. (1825) 23, t. 1, f. 7 (= *sericeus* Zimmermann = *australis* Sloane).
    LUZON, Laguna Province, Mount Maquiling.
  simplex SCHM. GOEB.,* Faun. Col. Birm. (1846) 89.
    MINDANAO, Zamboanga Province, Dapitan.

ALLOCOTA MOTSCHULSKY, Etudes Ent. (1859) 29.
  cyanipennis HELLER, Philip. Journ. Sci. 23 (1923) 305.
    MINDANAO, Bukidnon Province, Tangkulan. BASILAN.
  viridipennis MOTSCH., Etudes Ent. (1859) 30.
    MINDANAO, Agusan Province, Butuan. PALAWAN, Puerto Princesa.

AMBLYSTOMUS ERICHSON, Käf. Mark Brand. 1 (1837) 59 (= *Hispalis* Ramb. = *Megaristerus* Nietn. = *Thenarotidius* Sloane).
  guttatus BATES,* Trans. Ent. Soc. London (1873) 327.
    LUZON, Laguna Province, Los Baños; Mount Maquiling. MINDANAO, Surigao Province, Surigao.
  quadriguttatus MOTSCH.,* Etudes Ent. (1858) 24.
    LUZON, Laguna Province, Los Baños; Mount Maquiling.

ANAULACUS MACLEAY, Ann. jav. (1825) 22.
  [*fasciatus* SCHM. GOEB., Faun. Col. Birm. (1846) 89.]
  fasciatus var. basalis FLEUT.,* Ann. Soc. Ent. France (1887) 59, t. 4, f. 1.
    NEGROS, Oriental Negros Province, Cuernos Mountains.
  fasciatus var. philippinensis HELLER, Philip. Journ. Sci. 23 (1923) 302, t. 1, f. 2 (= *sericipennis* MacL. var. *philippinensis* Heller).
    MINDANAO, Lanao Province, Iligan.

ANCHISTA NIETNER, Journ. As. Soc. Beng. 6 (1856) 523 (= *Paraphaea* Bates).
  binotata DEJ.,* Spec. Gen. 1 (1825) 252 (= *discophora* Chaud. = *signifera* Bates).
    LUZON, Laguna Province, Los Baños.

ANCHOMENUS STEPHENS, Ill. Brit. Ent. 1 (1827) 67 and 81 (= *Platynus* Steph. = *Agonum* Steph. = *Agonothorax* Motsch.).

quadripunctatus DEGEER, Mem. Ins. 4 (1774) 102 (= *nigrosericans* Heller).
LUZON, Benguet Subprovince, Mount Santo Tomas.

ANOPLOGENIUS CHAUDOIR, Bull. Mosc. 1 (1852) 88.

microgonus BATES,* Ann. Mag. Nat. Hist. V 17 (1886) 78.
LUZON, Laguna Province, Los Baños; Mount Maquiling.

APOTOMUS ILLIGER, Mag. Ins. 6 (1807) 348.

xanthotelus BATES, Ent. Month. Mag. 11 (1874) 95 [= ? *fuscus* Motsch. = *sumbawanus* † Heller (not Dupuis)].
LUZON, Laguna Province, Los Baños; Mount Maquiling.

APRISTUS CHAUDOIR, Enumération des Carabiques et Hydrocanthares recueillis pendant un voyage au Caucase et dans les provinces transcaucasiennes.

cuprascens BATES,* Trans. Ent. Soc. London (1873) 309.
LUZON, Laguna Province, Mount Maquiling.

ARISTOLEBIA BATES, Ann. Mus. Civ. Gen. (1892) 428 (= *Hoplomenes* Heller).

davaonis HELLER, Philip. Journ. Sci. 19 (1921) 529, t. 1, f. 3.
MINDANAO, Davao Province, Davao. SAMAR.

BEMBIDION LATREILLE, Hist. Nat. Crust. et Ins. 3 (1802) 82.

bakeri ANDR., Ent. Month. Mag. (1924) 197.
LUZON, Benguet Subprovince, Baguio.

niloticum DEJ.,* Spec. Gen. 5 (1831) 73 (= *hamatum* Kol. = *batesi* Putz.).
LUZON, Laguna Province, Los Baños.

BRACHIDIUS CHAUDOIR, Bull. Mosc. 1 (1852) 78.

crassicornis CHAUD., Bull. Mosc. 1 (1852) 80 (= *corpulentus* Chaud.).
LUZON, Laguna Province, Mount Maquiling; Mount Banahao.

BRACHINUS WEBER, Obs. Ent. (1801) 22.

luzonicus CHAUD., Ann. Soc. Ent. Belg. (1876) 68.
LUZON, Laguna Province, Los Baños; Mount Maquiling.

piceus CHAUD., Ann. Soc. Ent. Belg. (1876) 53.
Philippine Islands.

BRACHYCTIS CHAUDOIR, Ann. Soc. Ent. Belg. 12 (1869) 252.

rugulosa CHAUD.,* Ann. Soc. Ent. Belg. 12 (1869) 252.
MINDANAO, Lanao Province, Iligan.

CALLEIDA LATREILLE and DEJEAN, Hist. Nat. et Icon. Col. Eur. (1822) 132.

discoidalis HELLER, Philip. Journ. Sci. 19 (1921) 529.
MINDANAO, Davao Province, Davao.

spendidula F., Syst. Eleuth. 1 (1801) 184.
LUZON, Laguna Province, Mount Maquiling: Tayabas Province, Malinao: Nueva Vizcaya Province, Imugan.

splendidula var. rubricata MOTSCH.,* Bull. Mosc. 3 (1864) 238.
LUZON. MINDANAO.

CATASCOPUS KIRBY, Trans. Linn. Soc. **14** (1825) 94.

aequatus DEJ., Spec. Gen. **5** (1831) 452.
LUZON, Manila: Benguet Subprovince, Baguio. POLILLO.

elegans WEBER, Obs. Ent. (1801) 45.
LUZON. PALAWAN, Puerto Princesa.

facialis WIED., Zool. Mag. I **3** (1819) 165 (*teste* Bates).
Philippine Islands.

simplex CHAUD., Rev. et Mag. Zool. (1872) 246.
MINDANAO.

smaragdulus DEJ.,* Spec. Gen. 1 (1825) 331.
SAMAR.

CELAENEPHES SCHMIDT-GOEBEL, Faun. Col. Birm. (1846) 77.

parallelus SCHM. GOEB.,* Faun. Col. Birm. (1846) 78, t. 2, f. 5.
BASILAN. SIBUYAN.

CHLAENIUS DEJEAN, Spec. Gen. **2** (1826) 297.

bimaculatus DEJ.,* Spec. Gen. **2** (1826) 301.
Philippine Islands.

flaviguttatus MACL., Ann. jav. (1825) 15 = *binotatus* Dej. = *punctatus* || Chaud. (not Motsch.) = *maculifer* Cast. = *puncticeps* Mun. Cat.]

flaviguttatus var. guttatus ESCHSCH., Zool. Atl. **5** (1833) 26, t. 25, f. 8 [= *biguttatus* || Montr. (not Motsch.)].
LUZON, Manila: Laguna Province, Los Baños; Mount Maquiling. SAMAR.

[*guttula* CHAUD., Bull. Mosc. **3** (1856) 216.]

guttula var. cuspidatus HELLER, Philip. Journ. Sci. **23** (1923) 301.
LUZON, Laguna Province, Los Baños. MINDANAO, Davao Province, Davao.

hamatus DEJ., Spec. Gen. **5** (1831) 633.
LUZON, Manila: Laguna Province, Los Baños. MINDANAO, Davao Province, Davao.

leucops WIED., Zool. Mag. II 1 (1823) 52 (= *aeruginosus* Chaud.).
LUZON, Manila.

luzonicus CHAUD., Bull. Mosc. **3** (1856) 261.
LUZON, Laguna Province, Los Baños.

semperi CHAUD., Ann. Mus. Civ. Gen. 8 (1876) 92.
Philippine Islands.

CLIVINA LATREILLE, Hist. Nat. Crust. et Ins. **3** (1802) 96.

castanea WESTW., Proc. Zool. Soc. (1837) 128 (= *clivinoides* Schm. Goeb., fig. only = *parryi* Putz. = *lata* Putz.).
LUZON, Laguna Province, Los Baños; Mount Maquiling.

vulgivaga BOH.,* Eug. Res. Zool. Col. (1861) 9 (=*humilis* Morow.). LUZON, Laguna Province, Mount Maquiling. MINDANAO, Davao Province, Davao.

CAELOSTOMUS MACLEAY, Ann. jav. (1825) 23 (= *Stomonoxus* Motsch.).

picipes MACL.,* Ann. jav. (1825) 24 [= *rufipes* Boh. = *striaticollis* † Chaud. (not Dej.)].

COLPODES MACLEAY, Ann. jav. (1925) 17 (= *Dyscolus* Dej. = *Loxocrepis* Eschsch.).

abropoides CHAUD., Ann. Soc. Ent. France (1878) 361.
Philippine Islands.

andrewesi HELLER, Ent. Mitt. (1926) 92 [= *rufitarsis* † Heller (not Chaud.)].
MINDANAO, Agusan Province, Butuan.

buchanani HOPE, Zool. Misc. (1831) 21 (= *amoenus* Chaud. = *splendens* Morow.).
LUZON, Benguet Subprovince, Baguio.

laetus ERICHS., Nov. Act. Leop. Carol. (1835) Suppl. 222, t. 37, f. 2 (=*apicalus* Chaud.) LUZON.

luzonicus CHAUD., Ann. Soc. Ent. France (1878) 366.
LUZON, Laguna Province, Mount Maquiling; Mount Banahao.

obscuritarsis CHAUD., Ann. Soc. Ent. France (1878) 375.
MINDANAO, Agusan Province, Butuan.

ruficeps MACL., Ann. jav. (1825) 25 [= *dohrni* Nietn. = *cyanipennis* † Chaud. (not Schm. Goeb. = *schmidti* Chaud.)].
LUZON, Manila.

COPTODERA DEJEAN, Spec. Gen. 1 (1825) 273 (= *Belonognatha* Chaud.).

eluta ANDR., Trans. Ent. Soc. London (1923) 30 [= *interrupta* † Chaud. (not Schm. Goeb.) = *elegantula* † Bates (not Schm. Goeb.)].
LUZON, Tayabas Province, Malinao. MINDANAO, Lanao Province, Iligan: Surigao Province, Surigao. NEGROS, Oriental Negros Province, Cuernos Mountains. SIBUYAN. BASILAN.

flexuosa SCHM. GOEB., Faun. Col. Birm. (1846) 55.
LUZON, Mount Banahao.

tetrastigma CHAUD.,* Ann. Soc. Ent. Belg. 12 (1869) 163.
LUZON, Laguna Province, Mount Maquiling. MINDANAO, Lanao Province, Kolambugan: Davao Province, Davao: Surigao Province, Surigao.

CYCLOSOMUS LATREILLE, in Cuvier's Reg. Anim. ed. 2 4 (April, 1829) 394 (note).

philippinus HELLER, Philip. Journ. Sci. 23 (1923) 302, t. 1., f. 3.
LUZON, Laguna Province, Los Baños.

DESERA HOPE, Col. Man. 2 (1838) 105 (= *Dendrocellus* Schm. Goeb.).

geniculata KLUG, Jahrb. Ins. (1834) 52.
LUZON, Laguna Province, Los Baños. MINDANAO, Davao Province, Davao.

schultzei HELLER, Philip. Journ. Sci. 23 (1923) 303 and 304.
LUZON, Rizal Province, Montalban Gorge.

DICRANONCUS CHAUDOIR, Bull. Mosc. 2 (1850) 392.
amabilis CHAUD.,* Ann. Soc. Ent. France (1859) 350 (note) and 359 [= *ruficeps* † Brullé (not MacL.)].
LUZON, Laguna Province, Mount Maquiling. PALAWAN.

DICRASPEDA CHAUDOIR, Bull. Mosc. 4 (1862) 300 (= *Eudalia* Cast.).
brunnea CHAUD.,* Bull. Mosc. 4 (1862) 300 (= *nitida* Sloane).
MINDANAO, Surigao Province, Surigao.

DIORYCHE MACLEAY, Ann. jav. (1825) 21.
torta MACL.,* Ann. jav. (1825) 21 (var.) (= *amoena* Dej. = *laetula* Bates).
LUZON, Laguna Province, Mount Maquiling.

DIPLOCHEILA BRULLÉ, in Audonin et Brullé Hist. Nat. 4 (1834) 407 [= *Rembus* ‖ Dej. (not Germ.) = *Eccoptogenius* Chaud. = *Symphyus* Nietn.)].
colossus BATES,* Ann. Mus. Civ. Gen. (1892) 326 [= *impressa* † Redt. (not F.)].
LUZON, Manila.
laevigata BATES,* Ann. Mus. Civ. Gen. (1892) 326 [= *polita* † MacL. (not F.) = *moesta* † Bates (not Chaud.)].
LUZON, Laguna Province, Mount Maquiling.

DISCHISSUS BATES, Trans. Ent. Soc. London (1873) 243.
notulatus F., Syst. Eleuth. 1 (1801) 201 (= *longicornis* Schaum = *sumatranus* Dohrn).
LUZON, Laguna Province, Mount Maquiling.

DOLICHOCTIS SCHMIDT-GOEBEL, Faun. Col. Birm. (1846) 62.
gilvipes DEJ., Spec. Gen. 5 (1831) 396.
LUZON, Laguna Province, Los Baños; Mount Maquiling. MINDANAO, Surigao Province, Surigao.
tetracolon CHAUD.,* Ann. Soc. Ent. Belg. 12 (1869) 248.
MINDANAO, Bukidnon Province, Tangkulan: Agusan Province, Butuan: Davao Province, Davao: Zamboanga Province, Zamboanga (var.); Dapitan: Surigao Province, Surigao (var.). BASILAN.

DRYPTA LATREILLE, Précis des caractères génériques des Insectes (1796) 75.
lineola MACL., Ann. jav. (1825) 27.
LUZON, Manila.
lineola var. **philippinensis** CHAUD., Bull. Mosc. 2 (1877) 262.
LUZON, Manila.

ENDYNOMENA CHAUDOIR, Ann. Soc. Ent. Belg. 15 (1872) 86 (= *Saronychium* Blackb.).
pradieri FAIRM.,* Rev. et Mag. Zool. (1849) 34 (= *inconspicua* Blackb.).
Philippine Islands.

EUPLYNES SCHMIDT-GOEBEL, Faun. Col. Birm. (1846) 52.
cyanipennis SCHM. GOEB.,* Faun. Col. Birm. (1846) 52.
MINDANAO, Surigao Province, Surigao.

EUSCHIZOMERUS CHAUDOIR, Bull. Mosc. 2 (1850) 413.
rufipes HELLER, Philip. Journ. Sci. 19 (1921) 526.
LUZON, Laguna Province, Mount Maquiling.
rufipes var. pilosulus HELLER, Philip. Journ. Sci. 23 (1923) 301.
PANAY, Capiz Province, Culasi.

GNATHAPHANUS MACLEAY, Ann. jav. (1825) 20 (= *Pachauchenius* W. MacL.).
impressipennis CAST.,* Trans. Roy. Vict. Soc. 8 (1868) 186.
MINDANAO, Davao Province, Davao.
philippensis CHEVR., Rev. Zool. (1841) 221 (= *laeviceps* W. MacL.).
LUZON, Manila.
punctilabris MACL., Ann. jav. (1825) 20 (= *javanus* Dej. = *dispellens* Walk. = *gnathaphanoides* Bates).
LUZON, Manila: Laguna Province, Mount Maquiling.
vulneripennis MACL., Ann. jav. (1825) 20 (= *subcostatus* Dej. = *melanarius* Boh.).
LUZON, Manila.

HOLOLEIUS LAFERTÉ, Ann. Soc. Ent. France (1851) 214 and 274.
nitidulus DEJ.,* Spec. Gen. 2 (1826) 341 (= *ceylanicus* Nietn. = *punctulatus* Chaud. = ? *ornatus* Tryon).

LESTICUS DEJEAN, Spec. Gen. 3 (1828) 189.
busuangae HELLER, Philip. Journ. Sci. 23 (1923) 299 and 300.
BUSUANGA.
cupreatus HELLER, Philip. Journ. Sci. 23 (1923) 299 and 300.
LUZON, Laguna Province, Los Baños; Mount Maquiling.
gregori KUNTZ., Ent. Rundsch. (1911) 175 (= *mac-gregori* Heller).
LUZON, Benguet Subprovince, Irisan.
[*insignis* GESTRO, Ann. Mus. Civ. Gen. (1882) 310.]
insignis var. philippinicus KUNTZ., Ent. Rundsch. (1911) 175.
CEBU, Toledo.
prasinus TCHITCH., Hor. Soc. Ent. Ross. 34 (1900) 178 and 193.

LIOPTERA CHAUDOIR, Ann. Soc. Ent. Belg. 12 (1869) 208.
quadriguttata CHAUD., Ann. Soc. Ent. Belg. 12 (1869) 208.
LUZON, Laguna Province, Mount Maquiling.

LYMNASTIS MOTSCHULSKY, Etudes Ent. (1862) 27 (= *Zuphiolum* Fairm.).
pilosus BATES,* Ann. Mus. Civ. Gen. (1892) 296 (= *setiger* Sloane).

MACROCHEILUS HOPE, Col. Man. 2 (1838) 166 (= *Acanthogenius* Reiche).
chaudoiri ANDR., Trans. Ent. Soc. London (1919) 130 [= *trimaculatus* || Chaud. (not Oliv.) = *ruficollis* Heller)].
LUZON, Laguna Province, Los Baños.

trimaculatus OLIV., Enc. Méth. Ins. 2 (1790) 347, t. 179, f. 11 [= *bensoni* Hope = *quadrimaculatus* Guér. = *tripustulatus* † Guér. (not Dej.) = *tripustulatus* † Redt. (not F.)].
LUZON, Laguna Province, Los Baños; Mount Maquiling.

MICROLESTES SCHMIDT-GOEBEL, Faun. Col. Birm. (1846) 41 (= *Blechrus* Motsch.).

glabratus † REDT. (not Dufts.), Reise Novara Zool. 2 (1867) Col. 7 (note 1).
LUZON, Manila.

MISCELUS KLUG, Jahrb. Ins. (1834) 82 (= *Leptodactyla* Brullé).

javanus KLUG, Jahrb. Ins. (1834) 82, t. 1, f. 9 (= *apicalis* Brullé = *paradoxus* Putz. = *convexicollis* Putz. = *vulneratus* Putz. = *planatus* Schauf.).
LUZON, Laguna Province, Mount Maquiling. MINDANAO, Bukidnon Subprovince, Tangkulan.

javanus var. unicolor PUTZ.,* Mém. Soc. Liège 2 (1845) 375 (= *rufiventris* Walk. = *ceylonicus* Chaud. = *stygicus* Putz. = *morioformis* W. MacL. = *celebensis* Schauf.).
LUZON, Laguna Province, Los Baños; Mount Maquiling; Mount Banahao. SIBUYAN.

MOCHTHERUS SCHMIDT-GOEBEL, Faun. Col. Birm. (1846) 76 (= *Cyrtopterus* Motsch.).

tetraspilotus MACL., Ann. jav. (1825) 25 (= *tetrasemus* Dej. = *angulatus* Schm. Goeb. = *retractus* Walk. = *quadrinotatus* Motsch.).
LUZON, Laguna Province, Mount Maquiling: Tayabas Province, Malinao. MINDANAO, Zamboanga Province, Zamboanga.

MORIO LATREILLE, Consid. Gén. (1810) Tab. Méth. 159.

angustus CHAUD., Bull. Mosc. 2 (1880) 346.
Philippine Islands.

cucujoides WALK., Ann. Mag. Nat. Hist. III 2 (1858) 203 [= *trogositoides* ‖ Walk. (not Chaud.) = *cordicollis* Chaud.].
LUZON, Laguna Province, Mount Maquiling. MINDANAO, Surigao Province, Surigao.

luzonicus CHAUD., Bull. Mosc. 1 (1852) 81 (= *intermedius* Chaud.).
LUZON, Manila: Laguna Province, Los Baños; Mount Maquiling.

orientalis DEJ.,* Spec. Gen. 1 (1825) 432 [= *walkeri* Putz. = *subconvexus* Chaud. = *submarginatus* Chaud. = *cucujoides* † Chaud. (not Walk.)].
Philippine Islands.

ODACANTHA PAYKULL, Faun. Suec. 1 (1798) 169 (= *Casnonia* Latr. and Dej. = *Arame* Andr.).

bimaculata REDT.,* in Hügel's Kaschmir IV 2 (1844) 498, t. 23, f. 2.
Philippine Islands.

OODES DEJEAN, Spec. Gen. 2 (1826) 374.

piceus NIETN.,* Journ. As. Soc. Bengal 6 (1856) 526 (= *vilus* Chaud.).
LUZON, Laguna Province, Los Baños; Mount Maquiling.

virens WIED., Zool. Mag. II 1 (1823) 50 (= *varians* Chaud.).
LUZON.

OPHIONEA KLUG, Ent. Braz. Spec. (1821) 298 (= *Casnoidea* Cast.).

bakeri DUPUIS, Ann. Soc. Ent. Belg. (1913) 270 [= *bhamoensis* † Maindr. (not Bates)].
LUZON, Laguna Province, Los Baños; Mount Maquiling.

ORTHOGONIUS MACLEAY, Ann. jav. (1825) 26 (= *Apsectra* Schm. Goeb. = *Haplopisthius* Chaud. = *Maraga* Walk.).

alternans WIED., Zool. Mag. II 1 (1823) 52 [= *duplicatus* † Bates (not Wied.) (part)].
LUZON, Manila.

hypocrita CHAUD., Ann. Soc. Ent. Belg. 14 (1871) 102.
LUZON, Laguna Province, Los Baños.

luzonicus CHAUD., Ann. Soc. Ent. Belg. 14 (1871) 123.
MINDANAO, Lanao Province, Kolambugan: Surigao Province, Surigao. SAMAR.

PACHYTRACHELUS CHAUDOIR, Bull. Mosc. 1 (1852) 85 (= *Batoscelis* Schm. Goeb., fig. only = ? *Systenognathus* Putz.).

oblongus DEJ., Spec. Gen. 5 (1831) 813 [= *angulatus* F. 1801 (not F. 1781) = *politus* Schm. Goeb., fig. only = *ceylonicus* Motsch.].
LUZON, Manila; Laguna Province, Los Baños; Mount Maquiling.

PENTAGONICA SCHMIDT-GOEBEL, Faun. Col. Birm. (1846) 47 [= *Rhombodera* || Reiche (not Burm.) = *Didetus* Lec. = *Elliotia* Nietn. = *Trichothorax* Montr. = *Xenothorax* Woll. = *Wakefieldia* Brown].

pallipes NIETN.,* Journ. As. Soc. Beng. 6 (1856) 525.
LUZON, Laguna Province, Mount Maquiling.

ruficollis SCHM. GOEB.,* Faun. Col. Birm. (1846) 48 (= *dichroa* Sloane).
SAMAR.

varicornis HELLER, Deutsch. Ent. Zeitschr. (1916) 269.
LUZON, Laguna Province, Mount Maquiling.

PERICALUS MACLEAY, Ann. jav. (1825) 15 (=*Coeloprosopus* Chaud.).

cicindeloides MACL.,* Ann. jav. (1825) 16, t. 1, f. 2.
PALAWAN.

levifrons HELLER, Deutsch. Ent. Zeitschr. (1916) 273.
MINDANAO, Agusan Province, Butuan: Surigao Province, Surigao.

philippinus HELLER, Deutsch. Ent. Zeitschr. (1916) 274, t. 3, f. 1.
LUZON, Mount Banahao.

quadrimaculatus MACL.,* Ann. jav. (1825) 15 (= *quadrisignatus* Cast.).
PALAWAN.

undatus CHAUD. Bull. Mosc. 1 (1848) 111.
LUZON, Laguna Province, Mount Maquiling: Benguet Subprovince, Baguio.

PERIGONA CASTELNAU, Etudes Ent. (1835) 151 (= *Nestra* Motsch. = *Trechicus* Lec. = *Spathinus* Nietn. = *Pentoplogenius* Morow. = *Siltopia* Cast. = *Extromus* Péring.).

livens PUTZ.,* Ann. Mus. Civ. Gen. (1873) 25.
LUZON, Laguna Province, Mount Maquiling. MINDANAO, Lanao Province, Iligan.

luzonica PUTZ., Ann. Mus. Civ. Gen. (1875) 728.
LUZON, Manila.

nigriceps DEJ.,* Spec. Gen. 5 (1831) 44 (= *umbripennis* Lec. = *fimicola* Woll. = *jansoniana* Woll. = *atriceps* Fairm. = *japonica* Bates = *beccarii* Putz. = *discalis* Chaud. = *suffusa* Bates = *pusilla* Péring. = *australica* Sloane).
LUZON, Laguna Province, Mount Maquiling.

plagiata PUTZ.,*Ann. Mus. Civ. Gen. (1875) 734 (= *nana* Bates).
LUZON, Mount Banahao. MINDANAO, Lanao Province, Kolambugan: Surigao Province, Surigao. PALAWAN, Puerto Princesa.

PERILEPTUS SCHAUM, Nat. Ins. Deutschl. 1 (1860) 663 (= *Blemus* † Dej. (not Steph.) = *Ochthephilus* ‖ Nietn. (not Muls.) = *Pyrrhotachys* Sloane.

melas JEANN., Mon. des Trechinæ (i) Ab. XXXII (1926) 416.
LUZON, Laguna Province, Mount Maquiling. MINDANAO.

PERONOMERUS SCHAUM, Ann. Soc. Ent. France (1853) 440.

fumatus SCHAUM, Ann. Soc. Ent. France (1853) 440 [= *nigrinus* † Heller (not Bates)].
LUZON, Laguna Province, Mount Maquiling.

PHEROPSOPHUS SOLIER, Ann. Soc. Ent. France (1833) 461.

emarginatus CHAUD., Ann. Soc. Ent. Belg. (1876) 20.
Philippine Islands.

fumigatus DEJ., Spec. Gen. 1 (1825) 307.
MINDANAO.

gironieri EYD. and SOUL., Rev. Zool. (1839) 264.
LUZON. MINDANAO.

javanus DEJ.,* Spec. Gen. 1 (1825) 305 [= *interruptus* † Schm. Goeb. (not Dej.) = *fimbriatus* Chaud. = *agnatus* Chaud.].
LUZON, Laguna Province, Los Baños.

PHLOEODROMIUS W. MACLEAY, Trans. Ent. Soc. N. S. Wales 2 (1871) 85 (= *Crossoglossa* Chaud.).

fasciatus CHAUD.,* Ann. Soc. Ent. Belg. 15 (1872) 179.
PALAWAN.

hastatus HELLER, Philip. Journ. Sci. 19 (1921) 528, t. 1, f. 2.
MINDANAO, Davao Province, Davao.

sellatus HELLER, Philip. Journ. Sci. 19 (1921) 526, t. 1, f. 1.
MINDANAO, Davao Province, Davao.

PHYSODERA ESCHSCHOLTZ, Zool. Atl. 2 (1829) 8.

dejeani ESCHSCH., Zool. Atl. 2 (1829) 8, t. 8, f. 6.
MINDANAO, Lanao Province, Iligan.

eburata HELLER, Philip. Journ. Sci. 23 (1923) 304 and 305, t. 1, f. 4.
LUZON, Laguna Province, Los Baños.

eschscholtzi PARRY, Trans. Ent. Soc. London (1849) 179, t. 18, f. 2 (= *davidis* Fairm.).
Philippine Islands.

PLATYMETOPUS DEJEAN, Spec. Gen. 4 (1829) 68.

[*flavilabris* F., Suppl. Ent. Syst. (1798) 59.]

flavilabris var. **thunbergi** QUENS., in Schönh. Syn. I 1 (1806) 188 (note) (= *punctulatus* MacL. = *obscuripes* Schauf.).
LUZON, Manila: Laguna Province, Mount Maquiling.

laticeps DEJ., Spec. Gen. 4 (1829) 76.
LUZON, Manila. MINDANAO, Zamboanga Province, Dapitan.

POGONOGLOSSUS CHAUDOIR, Bull. Mosc. 4 (1862) 304 (= *Libresthis* Schm. Goeb., fig. only = *Carpaulum* Sloane).

tagalus HELLER, Deutsch. Ent. Zeitschr. (1916) 271, t. 3, f. 2.
LUZON, Laguna Province, Mount Maquiling.

SCARITES FABRICIUS, Syst. Ent. (1775) 249.

longiusculus CHAUD., Ann. Soc. Ent. Belg. (1880) 86.
MINDORO, Mansalay.

semirugosus CHAUD., Bull. Mosc. 1 (1855) 90 (= *rugipennis* Chaud.).
LUZON, Manila.

STENOLOPHUS LATREILLE, in Cuvier's Règ. Anim. ed. 2 4 (April, 1829) 391 (= *Egadroma* Motsch.).

smaragdulus F.,* Suppl. Ent. Syst. (1798) 60 (= *trechoides* Hope = *stolidus* Walk. = *transmutans* Bates = *cyanellus* Bates).
MINDANAO, Davao Province, Davao.

smaragdulus var. **quinquepustulatus** WIED.,* Zool. Mag. II 1 (1823) 58.
LUZON, Laguna Province, Los Baños; Mount Maquiling. MINDANAO, Zamboanga Province, Dapitan.

STENOTELUS BOUCHARD, Ann. Soc. Ent. France (1903) 174.

opacus BOUCH.,* Ann. Soc. Ent. France (1903) 175.
MINDANAO, Davao Province, Davao.

? **SYSTOLOCRANIUS** CHAUDOIR, Bull. Mosc. 3 (1857) 23.

sulcatus ESCHSCH., Zool. Atl. 5 (1833) 28 (? = *linea* Wied. = *grandis* Dej.).

TACHYS STEPHENS, Ill. Brit. Ent. 2 (1828) 2 and 4.

barringtoni ANDR., Ann. Mus. Civ. Gen. (1925) 423.

LUZON, Laguna Province, Mount Maquiling: Rizal Province, Montalban. PALAWAN, Puerto Princesa.

ceylanicus NIETN., Ann. Mag. Nat. Hist. III 2 (1858) 423 (= *flaviculus* Motsch. = *anceps* Putz. = *infans* Bates).

LUZON, Manila: Rizal Province, Montalban: Laguna Province, Mount Maquiling; Pagsanjan: Bataan Province, Lamao: Mountain Province, Tinglayan. MINDANAO. SAMAR, Catbalogan. MINDORO, San Teodoro.

coracinus PUTZ.,* Ann. Mus. Civ. Gen. (1875) 739 (= *remotiporis* Bates).

LUZON, Laguna Province, Mount Maquiling.

fumigatus MOTSCH.,* Bull. Mosc. 4 (1851) 509 (= *emarginatus* Nietn.).

LUZON, Manila: Laguna Province, Los Baños; Mount Maquiling; Pagsanjan: Rizal Province, Montalban: Bataan Province, Lamao. MINDANAO, Surigao Province, Surigao.

haliploides BATES, Ann. Mus. Civ. Gen. (1892) 289 (? = *latissimus* Motsch.).

LUZON, Laguna Province, Los Baños (var.); Mount Maquiling.

imperfectus ANDR., Ann. Mus. Civ. Gen. (1925) 413.

LUZON, Rizal Province, Montalban.

impressipennis MOTSCH.,* Etudes Ent. (1859) 39 (= *dohertyi* Jord. = *sinuaticollis* Sloane).

LUZON, Manila.

klugi NIETN.,* Ann. Mag. Nat. Hist. III 2 (1858) 423 (= *sulculatus* Putz. = *euglyptus* Bates = *feanus* Bates).

PALAWAN, Puerto Princesa.

klugi var. sulcatopunctatus PUTZ., Ann. Mus. Civ. Gen. (1875) 742.

LUZON, Manila: Laguna Province, Los Baños; Mount Maquiling: Rizal Province, Montalban. MINDANAO, Agusan Province, Butuan.

ornatus APETZ, Col. Brehm (1854) 12 (= *orientalis* Nietn.).

LUZON, Mountain Province, Tinglayan.

ovatus MOTSCH.,* Bull. Mosc. 4 (1851) 509 (= *albicornis* Schaum = *mirabilis* Bates = *mirandus* Dupuis).

LUZON, Laguna Province, Mount Maquiling.

plagiatus PUTZ., Ann. Mus. Civ. Gen. (1875) 745 (= *doddi* Sloane).

Philippine Islands.

plagiatus var. longulus ANDR., Ann. Mus. Civ. Gen. (1925) 371.

LUZON, Manila.

pulcher ANDR., Ann. Mus. Civ. Gen. (1925) 428.

MINDANAO, Zamboanga Province, Zamboanga.

punctus ANDR., Ann. Mus. Civ. Gen. (1925) 473.

LUZON, Laguna Province, Mount Maquiling.

punctus var. variabilis ANDR., Ann. Mus. Civ. Gen. (1925) 474.

MINDORO, Mindoro Province, Calapan.

[*quadrillum* SCHAUM, Berl. Ent. Zeitschr. (1860) 201 (= *pictipennis* Putz. = *spilotus* Bates).

quadrillum var. impictus ANDR., Ann. Mus. Civ. Gen. (1925) 373.
LUZON, Manila.

serratus ANDR., Ann. Mus. Civ. Gen. (1925) 344.
LUZON, Laguna Province, Los Baños.

triangularis NIETN.,* Ann. Mag. Nat. Hist. III 2 (1858) 422 (= *atriceps* W. MacL. = *trechiformis* Jord.).
LUZON, Manila: Laguna Province, Los Baños; Mount Maquiling; Pagsanjan: Rizal Province, Montalban. MINDANAO, Davao Province, Davao.

truncatus NIETN.,* Ann. Mag. Nat. Hist. III 2 (1858) 421.
MINDORO, Calapan; San Teodoro.

umbrosus MOTSCH.,* Bull. Mosc. 4 (1851) 507 (= *parallelus* Motsch. = *extremus* Walk. = *nietneri* Schaum).
LUZON, Laguna Province, Mount Maquiling: Nueva Vizcaya Province, Imugan. MINDANAO, Surigao Province, Surigao.

THLIBOPS PUTZEYS, Ann. Soc. Ent. Belg. 10 (1867) 9.

abbreviatus HELLER, Philip. Journ. Sci. 23 (1923) 297 and 298.
LUZON, Rizal Province, Montalban.

glabriventris HELLER, Deutsch. Ent. Zeitschr. (1916) 276.
LUZON, Mount Banahao.

integricollis HELLER, Philip. Journ. Sci. 23 (1923) 296 and 298.
LUZON, Benguet Subprovince, Baguio: Zambales Province, Iba.

intermedius HELLER, Philip. Journ. Sci. 19 (1921) 530.
LUZON, Laguna Province, Los Baños; Mount Maquiling.

minor HELLER, Deutsch. Ent. Zeitschr. (1916) 275.
LUZON, Mount Banahao.

omega HELLER, Abh. Mus. Dresd. VII 8 (1899) 3.
LUZON. SIBUYAN.

TRECHODES BLACKBURN, Trans. Roy. Soc. S. Austr. 25 (1901) 119.

bakeri JEANN., Mon. des Trechinæ (i) XXXII (1926) 491, f. 266.
LUZON, Laguna Province, Mount Maquiling.

TRECHUS SCHELLENBERG, Helv. Ent. 2 (1806) 22 (= *Blemus* Steph.).

bakeri JEANN., Ann. Mag. Nat. Hist. IX 12 (1923) 416 and 426, f. 16.
LUZON, Benguet Subprovince, Baguio.

TRIGONOTOMA DEJEAN, Spec. Gen. 3 (1828) 182.

leotaudi TCHITCH., Hor. Soc. Ent. Ross. 34 (1900) 158 and 185.
LUZON, Manila.

luzonica CHAUD., Ann. Soc. Ent. Belg. 11 (1868) 161.
LUZON, Manila: Laguna Province, Mount Maquiling.

palawanica TCHITCH., Hor. Soc. Ent. Ross. 30 (1897) 263.
PALAWAN.

ALPHABETICAL LIST OF SYNONYMOUS AND SUBORDINATE GENERIC NAMES OCCURRING IN THIS CATALOGUE

Acanthogenius, *see* Macrocheilus.
Agonothorax, *see* Anchomenus.
Agonum, *see* Anchomenus.
Apsectra, *see* Orthogonius.
Arame, *see* Odacantha.
Batoscelus, *see* Pachytrachelus.
Belonognatha, *see* Coptodera.
Blechrus, *see* Microlester.
Blemus, *see* Perileptus; *see also* Trechus.
Carpaulum, *see* Pogonoglossus.
Casnoidea, *see* Ophionea.
Casnonia, *see* Odacantha.
Coeloprosopus, *see* Pericalus.
Crossoglossa, *see* Phloeodromius.
Cyrtopterus, *see* Mochtherus.
Dendrocellus, *see* Desera.
Didetus, *see* Pentagonica.
Dyscolus, *see* Colpodes.
Eccoptogenius, *see* Diplocheila.
Egadroma, *see* Stenolophus.
Elliotia, *see* Pentagonica.
Eudalia, *see* Dicraspeda.
Extromus, *see* Perigona.
Haplopisthius, *see* Orthogonius.
Hispalis, *see* Amblystomus.
Hoplomenes, *see* Aristolebia.
Leptodactyla, *see* Miscelus.
Libresthis, *see* Pogonoglossus.
Loxocrepis, *see* Colpodes.
Maraga, *see* Orthogonius.
Megaristerus, *see* Amblystomus.
Nestra, *see* Perigona.
Ochthephilus, *see* Perileptus.
Pachauchenius, *see* Gnathaphanus.
Paraphaea, *see* Anchista.
Pentoplogenius, *see* Perigona.
Platynus, *see* Anchomenus.
Pyrrhotachys, *see* Perileptus.
Rembus, *see* Diplocheila.
Rhombodera, *see* Pentagonica.
Saronychium, *see* Endynomena.
Siltopia, *see* Perigona.
Spathinus, *see* Perigona.
Stomonoxus, *see* Caelostomus.
Symphyus, *see* Diplocheila.
Systenognathus, *see* Pachytrachelus.
Thenarotidius, *see* Amblystomus.
Trechicus, *see* Perigona.
Trichothorax, *see* Pentagonica.
Wakefieldia, *see* Pentagonica.
Xenothorax, *see* Pentagonica.
Zuphiolum, *see* Lymnastis.

ALPHABETICAL LIST OF SPECIFIC NAMES

[Synonyms are printed in italics.]

abbreviatus (Thlibops).
abropoides (Colpodes).
adelioides (Aephnidius).
aequatus (Catascopus).
aeruginosus (Chlaenius).
agnatus (Pheropsophus).
albicornis (Tachys).
alternans (Orthogonius).
amabilis (Dicranoncus).
amoena (Dioryche).
amoenus (Colpodes).
anceps (Tachys).
andrewesi (Colpodes).
angulatus (Mochtherus).
angulatus (Pachytrachelus).
angustus (Morio).
annamensis (Acupalpus).
apicalis (Colpodes).
apicalis (Miscelus).
atriceps (Perigona).
atriceps (Tachys).
australica (Perigona).
australis (Aephnidius).
bakeri (Bembidion).
bakeri (Ophionea).
bakeri (Trechodes).
bakeri (Trechus).
barringtoni (Tachys).
basalis (Anaulacus).
batesi (Bembidion).
beccarii (Perigona).
bensoni (Macrocheilus).
bhamoensis (Ophionea).
biguttatus (Chlaenius).

bimaculata (Odacantha).
bimaculatus (Chlaenius).
binotata (Anchista).
binotatus (Chlaenius).
brunnea (Dicraspeda).
buchanani (Colpodes).
busuangae (Lesticus).
castanea (Clivina).
celebensis (Miscelus).
ceylanicus (Hololeius).
ceylanicus (Tachys).
ceylonicus (Miscelus).
ceylonicus (Pachytrachelus).
chaudoiri (Macrocheilus).
cicindeloides (Pericalus).
clivinoides (Clivina).
colossus (Diplocheila).
convexicollis (Miscelus).
coracinus (Tachys).
cordicollis (Morio).
corpulentus (Brachidius).
crassicornis (Brachidius).
cucujoides (Morio).
cuprascens (Apristus).
cupreatus (Lesticus).
cuspidatus (Chlaenius).
cyanellus (Stenolophus).
cyanipennis (Allocota).
cyanipennis (Colpodes).
cyanipennis (Euplynes).
davaonis (Aristolebia).
davidis (Physodera).
dejeani (Physodera).
dichroa (Pentagonica).
discalis (Perigona).
discoidalis (Calleida).
discophora (Anchista).
dispellens (Gnathaphanus).
doddi (Tachys).
dohertyi (Tachys).
dohrni (Colpodes).
duplicatus (Orthogonius).
eburata (Physodera).
elegans (Catascopus).
elegantula (Coptodera).
eluta (Coptodera).
emarginatus (Pheropsophus).
emarginatus (Tachys).
eschscholtzi (Physodera).
euglyptus (Tachys).
extremus (Tachys).
facialis (Catascopus).
fasciatus (Anaulacus).
fasciatus (Phloeodromius).
feanus (Tachys).
fimbriatus (Pheropsophus).
fimicola (Perigona).
flaviculus (Tachys).
flaviguttatus (Chlaenius).
flavilabris (Platymetopus).
flexuosa (Coptodera).
fumatus (Peronomerus).
fumigatus (Pheropsophus).
fumigatus (Tachys).
fuscus (Apotomus).
geniculata (Desera).
gilvipes (Dolichocitis).
gironieri (Pheropsophus).
glabratus (Microlestes).
glabriventris (Thlibops).
gnathaphanoides (Gnathaphanus).
grandis (Systolocranius).
gregori (Lesticus).
guttatus (Amblystomus).
guttatus (Chlaenius).
guttula (Chlaenius).
haliploides (Tachys).
hamatum (Bembidion).
hamatus (Chlaenius).
hastatus (Phloeodromius).
humilis (Clivina).
hypocrita (Orthogonius).
imperfectus (Tachys).
impictus (Tachys).
impressa (Diplocheila).
impressipennis (Gnathaphanus).
impressipennis (Tachys).
inconspicua (Endynomena).
infans (Tachys).
insignis (Lesticus).
integricollis (Thlibops).
interrupta (Coptodera).
interruptus (Pheropsophus).
intermedius (Morio).
intermedius (Thlibops).
jansoniana (Perigona).
japonica (Perigona).
javanus (Gnathaphanus).
javanus (Miscelus).
javanus (Pheropsophus).

klugi (Tachys).
laetula (Dioryche).
laetus (Colpodes).
laeviceps (Gnathaphanus).
laevigata (Diplocheila).
lata (Clivina).
laticeps (Platymetopus).
latissimus (Tachys).
leotaudi (Trigonotoma).
leucops (Chlaenius).
levifrons (Pericalus).
linea (Systolocranius).
lineola (Drypta).
livens (Perigona).
longicornis (Dischissus).
longiusculus (Scarites).
longulus (Tachys)
luzonica (Perigona).
luzonica (Trigonotoma).
luzonicus (Brachinus).
luzonicus (Chlaenius).
luzonicus (Colpodes).
luzonicus (Morio).
luzonicus (Orthogonius).
mac-gregori (Lesticus).
maculifer (Chlaenius).
melanarius (Gnathaphanus).
melas (Perileptus).
microgonus (Anoplogenius).
minor (Thlibops).
mirabilis (Tachys).
mirandus (Tachys).
moesta (Diplocheila).
morioformis (Miscelus).
nana (Perigona).
nietneri (Tachys).
nigriceps (Perigona).
nigrinus (Peronomerus).
nigrosericans (Anchomenus).
niloticum (Bembidium).
nitida (Dicraspeda).
nitidulus (Hololeius).
notulatus (Dischissus).
oblongus (Pachytrachelus).
obscuripes (Platymetopus).
obscuritarsis (Colpodes).
omega (Thlibops).
opacus (Stenotelus).
orientalis (Morio).
orientalis (Tachys).
ornatus (Hololeius).
ornatus (Tachys).
ovatus (Tachys).
palawanica (Trigonotoma).
paradoxus (Miscelus).
parallelus (Celaenephes).
parallelus (Tachys).
pallipes (Pentagonica).
parryi (Clivina).
philippensis (Gnathaphanus).
philippinensis (Anaulacus).
philippinensis (Drypta).
philippinicus (Lesticus).
philippinus (Cyclosomus).
philippinus (Pericalus).
piceus (Brachinus).
piceus (Oodes).
picipes (Caelostomus).
pictipennis (Tachys).
pilosulus (Euschizomerus).
pilosus (Lymnastis).
plagiata (Perigona).
plagiatus (Tachys).
planatus (Miscelus).
polita (Diplocheila).
politus (Pachytrachelus).
pradieri (Endynomena).
prasinus (Lesticus).
pulcher (Tachys).
punctatus (Chlaenius).
puncticeps (Chlaenius).
punctilabris (Gnathaphanus).
punctulatus (Hololeius).
punctulatus (Platymetopus).
punctus (Tachys).
pusilla (Perigona).
quadriguttata (Lioptera).
quadriguttatus (Amblystomus).
quadrillum (Tachys).
quadrimaculatus (Macrocheilus).
quadrimaculatus (Pericalus).
quadrinotatus (Mochtherus).
quadripunctatus (Anchomenus).
quadrisignatus (Pericalus).
quinquepustulatus (Stenolophus).
remotiporis (Tachys).
retractus (Mochtherus).
rubricata (Calleida).
ruficeps (Colpodes).
ruficeps (Dicranoncus).
ruficollis (Macrocheilus).
ruficollis (Pentagonica).

rufipes (Caelostomus).
rufipes (Euschizomerus).
rufitarsis (Colpodes).
rufiventris (Miscelus).
rugipennis (Scarites).
rugulosa (Brachyctis).
schmidti (Colpodes).
schultzei (Desera).
sellatus (Phloeodromius).
semirugosus (Scarites).
semperi (Chlaenius).
sericeus (Aephnidius).
sericipennis (Anaulacus).
serratus (Tachys).
setiger (Lymnastis).
signifera (Anchista).
simplex (Aephnidius).
simplex (Catascopus).
sinuaticollis (Tachys).
smaragdulus (Catascopus).
smaragdulus (Stenolophus).
spilotus (Tachys).
splendens (Colpodes).
splendidula (Calleida).
stolidus (Stenolophus).
striaticollis (Caelostomus).
stygicus (Miscelus).
subconvexus (Morio).
subcostatus (Gnathaphanus).
submarginatus (Morio).
suffusa (Perigona).
sulcatopunctatus (Tachys).
sulcatus (? Systolocranius).
sulculatus (Tachys).
sumatranus (Dischissus).
sumbawanus (Apotomus).
tagalus (Pogonoglossus).
tetracolon (Dolichoctis).
tetrasemus (Mochtherus).
tetraspilotus (Mochtherus).
tetrastigma (Coptodera).
thunbergi (Platymetopus).
torta (Dioryche).
transmutans (Stenolophus).
trechiformis (Tachys).
trechoides (Stenolophus).
triangularis (Tachys).
trimaculatus (Macrocheilus).
tripustulatus (Macrocheilus).
trogositoides (Morio).
truncatus (Tachys).
umbripennis (Perigona).
umbrosus (Tachys).
undatus (Pericalus).
unicolor (Miscelus).
variabilis (Tachys).
varians (Oodes).
varicornis (Pentagonica).
vilus (Oodes).
virens (Oodes).
viridipennis (Allocota).
vulgivaga (Clivina).
vulneratus (Miscelus).
vulneripennis (Gnathaphanus).
walkeri (Morio).
xanthotelus (Apotomus).

NEW OR LITTLE-KNOWN TIPULIDÆ FROM EASTERN ASIA (DIPTERA), PART I

By CHARLES P. ALEXANDER
Of Amherst, Massachusetts[1]

TWO PLATES

In the present paper, undescribed species of crane flies from various parts of China and Japan are considered. The paper is based to a large extent upon a very interesting series from Che-kiang, China, where they were collected by Mr. E. Suenson, in the hills south of Ning-po, halfway to Nimrod Sound. The Japanese species include material from Hokkaido taken by Messrs. Satoru Kuwayama and Matsuji Hori; from Honshiu and Shikoku, kindly submitted by Messrs. K. Takeuchi and C. Harukawa; and a species from Taiwan included in large series of Tipulidæ sent to me by Doctor Shiraki. I wish to express my sincere thanks to all of the above-mentioned entomologists for their kindness in collecting these fragile flies. The types of the species are preserved in my collection through the interest of the various collectors.

LIMONIINÆ

Dicranomyia paramorio sp. nov.

Belongs to the *morio* group; antennæ black throughout; thoracic pleura heavily pruinose; male hypopygium with the dorsal dististyle an acutely pointed cylindrical rod; ventral dististyle with the rostrum bearing a single long pale spine.

Male.—Length, about 4 millimeters; wing, 5.8.

Female.—Length, about 6.2 millimeters; wing, 7.

Rostrum and palpi black. Antennæ black throughout, the flagellar segments oval. Head black, the anterior vertex silvery.

Thorax shiny black, the pleura with a conspicuous microscopic gray pubescence that appears like a bloom, especially on the sternopleurite and the cephalic portion of the pteropleurite. Halteres yellow, the knobs dark brown. Legs with the coxæ yellow, the fore coxæ with the basal half dark brown; trochanters obscure yellow; femora yellowish brown, the fore femora more uniformly darker, the posterior femora paler, with the tips relatively narrowly darker. Tibiæ and tarsi brownish black. Wings (Plate 1, fig. 1) with a faint brownish tinge, the stigma oval, darker brown than the ground color; veins dark brown. Venation: Sc_1 ending opposite the origin of Rs, Sc_2 very far from its tip, at about two-thirds the length of Sc; Rs long, in alignment with R_{2+3}; tip of R_1 very faint. In the female, Sc_1 ends just beyond the origin of Rs.

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[1] Contribution from the Department of Entomology, Massachusetts Agricultural College.

Abdominal tergites brown, the caudal margins of the basal segments broadly obscure yellow; outer segments more uniformly darkened, including the hypopygium; basal sternites extensively obscure yellow. In the female, the basal sternites are bicolorous, the tergites more uniformly black, only the caudal margins of the segments being dark brown instead of black. Male hypopygium (Plate 2, fig. 1) with the basistyles, *b*, relatively small, the ventromesal lobe setiferous. Dorsal dististyle, *dd*, slender, the extreme tip suddenly narrowed into an acute point. Ventral dististyle, *vd*, fleshy, larger than the basistyle; rostrum slender, provided with a single long pale flattened spine arising from a short squat base, the spine longer than the rostrum beyond it; basad of this spine is a small tubercle that is otherwise unarmed. Gonapophyses, *g*, narrow, dark brown. Ædeagus, *a*, broad, the base setiferous. The dorsal dististyles are like those of the ordinary type of the *morio* group, but the ventral dististyle is more like that of the aberrant *D. pseudomorio* Alexander (eastern Asia).

Habitat.—China (Che-kiang).

Holotype, male, hills south of Ning-po, May 1, 1925 (*E. Suenson*). Allotopotype, female.

Antocha (Antocha) confluenta sp. nov.

General coloration brownish gray, the ventral thoracic pleurites lighter gray; rostrum obscure yellow; antennæ dark brown throughout; wings with a dusky tinge; cell 1st M_2 open by the atrophy of m.

Male.—Length, 5 to 5.5 millimeters; wing, 6 to 6.5. Rostrum obscure yellow, the palpi dark brown. Antennæ dark brown throughout; flagellar segments oval with a conspicuous white pubescence. Head dark gray.

Mesonotum dark brownish gray without evident stripes; posterior sclerites of the mesonotum somewhat paler. Pleura dorsally grayish brown, the sternopleurite and pteropleurite light gray pruinose. Halteres brown, the base of the stem narrowly pale. Legs with the coxæ and trochanters yellow; femora brownish testaceous to darker brown, the segments outwardly passing into darker. Wings (Plate 1, fig. 2) with a faint dusky tinge; stigma barely indicated, pale brown; veins pale brown. Macrotrichiæ restricted to the apical half of vein R_{4+5} and the apical two-fifths of veins M_{1+2} and M_3. Anal angle very conspicuous. Venation: r lying opposite or just beyond the level of r-m; cell 1st M_2 open by the atrophy of m; m-cu about one-third its length before the fork of M.

Abdomen dark brown, including the hypopygium; sternites 1 to 4 with a median yellow stripe. Male hypopygium (Plate 2, fig. 2) with the caudal margin of the ninth tergite, *t*, unequally trilobed, the broader lateral lobes provided with larger setæ, the small, low median lobe with a lesser number of small setæ. Basistyles, *b*, relatively short and stout. Dististyles, *d*, fused basally, the outer style chitinized, gently curved to the subacute tip, the apical portion carinate; inner style subequal in length, fleshy, provided with numerous small setæ. Gonapophyses, *g*, small and slender, the two taken together appearing lyriform, each apophysis gently sinuous. Ædeagus, *a*, broad.

Habitat.—China (Che-kiang).

Holotype, male, hills south of Ning-po, May 1, 1925 (*Suenson*). Paratopotypes, 3 males.

The present fly shows features of resemblance to the genus *Orimargula* Mik and tends to break down the distinctions between the two genera. Despite this point of contact, I consider that the two genera are sufficiently differentiated. *Antocha* is essentially Holarctic in its distribution, with numerous species in eastern Asia and a lesser number elsewhere in the Nearctic and Palæarctic Regions. A few species occur farther south but then only at higher altitudes in the Himalayas and the mountains of the East Indian islands. *Orimargula*, on the contrary, is essentially Palæotropical in its distribution, with only the genotype, *alpigena* Mik, and the small fly described hereinafter as *O. flavella* sp. nov., occurring in the Holarctic Region. In the Tropics the genus shows a great distribution in the Ethiopian Region, and again in Australia, occurring as far south as Tasmania. It is probable that future collecting will add much to our knowledge of these two genera.

Orimargula flavella sp. nov.

General coloration obscure testaceous yellow; rostrum obscure yellow; antennæ indistinctly bicolorous; head light silvery gray; wings subhyaline, the veins pale.

Female.—Length, about 3.5 to 3.7 millimeters; wing, 4.5. Rostrum obscure yellow; basal segments of palpi obscure yellow, the terminal segments passing into brown. Antennæ with the scapal segments obscure yellow; flagellar segments indistinctly bicolorous, the bases of the individual segments pale, the apices more infuscated, the amount of darkening increasing on the outer segments. Head light silvery gray.

Thorax obscure testaceous yellow, the pteropleurite with a vague darkening. Halteres pale. Legs with the coxæ and trochanters yellow; remainder of the legs pale, only the terminal tarsal segments faintly darker. Wings subhyaline, the veins pale. Macrotrichiæ on the distal three-fourths of R_{4+5} and M_{1+2}; all of M_3 except the base, and about six well scattered along vein M_4. Venation: r–m shorter than the basal section of R_{4+5}; r proximad of r–m, on R_{2+3} at about its own length beyond the end of Rs; cell M_3 about twice its petiole; m–cu very oblique, about two-thirds to three-fourths its own length before the fork of M.

Abdomen obscure yellow, the lateral margins of the tergites slightly darker.

Habitat.—China (Che-kiang).

Holotype, female, hills south of Ning-po, May 1, 1925 (*Suenson*). Paratopotype, 1 female.

Orimargula flavella fuscolineata subsp. nov.

Female.—Length, about 4 millimeters; wing, 4.8. Generally similar to the typical form, differing as follows:

Antennæ somewhat longer, the flagellum uniformly dark brown. Mesonotal præscutum yellow with a very broad, conspicuous, dark brown, median stripe that ends just before the suture, the posterior end feebly bifid. Scutum broadly pale medially, the lobes infuscated; scutellum concolorous with the median area of the scutum; postnotal mediotergite pale, more darkened behind. Pleura yellowish testaceous, the anepisternum infuscated. Bases of veins R_{4+5} and M_{1+2} more extensively glabrous. Venation as shown in Plate 1, fig. 3.

Habitat.—China (Che-kiang).

Holotype, male, hills south of Ning-po, May 1, 1925 (*Suenson*).

Molophilus velvetus sp. nov.

General coloration light gray, the pleura dark brown; head yellow, the center of the vertex blue-gray; knobs of the halteres dark; legs dark brown; abdomen dark brown, the hypopygium paler; outer lateral angle of basistyle of male hypopygium prolonged into a slender setiferous lobe.

Male.—Length, about 4 millimeters; wing, 5.2. Rostrum and palpi brownish black. Antennæ short, the basal segments yellowish, the terminal segments passing into brown; flagellar segments oval. Head obscure yellow, the vertex extensively blue-gray, this color reaching the posterior lateral angles of the eyes but the occipital region remaining pale.

Pronotum pale dorsally. Lateral pretergites very pale yellowish white. Mesonotal præscutum with a blue-gray bloom, the narrow brown interspaces indicated behind; pseudosutural foveæ and tuberculate pits dark; lateral margins of the præscutum behind the foveæ narrowly yellowish; scutum dark, pruinose; scutellum dark, the caudal margin narrowly brownish yellow; postnotum dark brown. Pleura dark brown. Halteres brown, the knobs dark brown. Legs with the fore coxæ dark brown, the middle and posterior coxæ paler; trochanters brownish yellow; remainder of the legs dark brown. Wings yellowish, the costal region brighter yellow; anal angle narrowly darkened; veins yellowish, the macrotrichiæ pale brown. Venation: Proximal end of cell R_3 lying far basad of either cell R_4 or R_5, the two latter subequal in length; m-cu near midlength of M_{3+4}; vein 2d A elongate, sinuous, ending about opposite the caudal end of the slightly oblique m-cu.

Abdomen dark brown, the hypopygium brownish yellow. Male hypopygium (Plate 2, fig. 11) with the outer lateral angle of the basistyle, *b*, produced caudad into a slender lobe, setiferous except for the restricted acute apex which is chitinized; mesal lobe of basistyle very broad and flattened, the margin with abundant erect setæ. Dististyles two, lying in the notch of the basistyle; outer dististyle, *od*, flattened, the apex narrower, the distal third with an appressed velvety pubescence; inner margin of the style with a series of microscopic conical roughenings; inner, dististyle, *id*, broad at base, prolonged caudad into a slender cylindrical rod, the surface with vague, microscopic appressed spinulæ.

Habitat.—China (Che-kiang).

Holotype, male, hills south of Ning-po, May 1, 1925 (*Suenson*).

Erioptera (Erioptera) harukawai sp. nov.

Male.—Length, about 4 to 4.2 millimeters; wing, 5.4 to 6. Generally similar to *E.* (*E.*) *elegantula* Alexander, differing chiefly in the wing pattern and the structure of the male hypopygium.

Flagellar segments shorter, more oval. Knobs of the halteres infuscated. Legs with the femoral bases broadly pale. Wings narrower, whitish subhyaline (Plate 1, fig. 4) with the brown pattern reduced to very tiny spots at the origin of Rs, Sc_2, r, tip of R_1, and as a vague seam along the cord, interrupted at the fork of M; veins brownish black. Venation: m-cu strongly sinuous; vein 2d A strongly sinuous, in some cases with a strong kink immediately beyond midlength. Male hypopygium with the acicular gonapophyses pale throughout. In *elegantula* they are heavily blackened apically.

Habitat.—Japan (Honshiu).

Holotype, male, Kurashiki, Okayama-ken, altitude 12 meters, April 6, 1925 (*C. Harukawa*). Paratopotypes, 6 males, April 2 to 16, 1925 (*Harukawa*); paratype, male, Gifu, Mino-no-kuni, May 3, 1921 (*K. Takeuchi*).

The species is named in honor of the collector, my friend Prof. C. Harukawa, entomologist of the Ohara Institute for Agricultural Research, to whom I am indebted for numerous Tipulidæ from Kurashiki and elsewhere in Japan.

Gonomyia (Ptilostena) kuwayamai sp. nov.

Female.—Length, about 5 millimeters; wing, 6 to 6.1. Closely related to *G.* (*P.*) *sachalinensis* Alexander (Karafuto), differing as follows:

Size smaller. Head grayish yellow, the center of the vertex darker. Mesonotal præscutum with the median brown stripe well indicated, the lateral stripes subobsolete; scutal lobes dark; scutellum reddish brown, somewhat testaceous; postnotal mediotergite dark medially, the sides paling to reddish brown. Pleura reddish without evident pale stripes as in *sachalinensis*. Halteres yellow, the knobs broken. Legs with the coxæ and trochanters reddish; femora yellow, passing into dark brown, this color very extensive on the fore legs where it includes more than the distal two-thirds, narrower on the hind legs where less than the distal third is darkened; tibiæ light brown, the tips narrowly blackened; tarsi brownish black, the basitarsi paler at proximal ends. Wings (Plate 1, fig. 5) with a strong yellowish tinge, the costal region and the space between the branches of Cu lighter yellow; stigma small; veins dark brownish yellow. Venation: Sc_1 ending shortly before midlength of the relatively short, arcuated Rs, Sc_2 before the origin of Rs; R_{2+3} relatively short and straight, only a little longer than the petiole of cell 2d M_2; in *sachalinensis* (Plate 1, fig. 6) R_{2+3} is long and gently arcuated, nearly twice as long as the petiole of cell 2d M_2; veins R_1 and R_2 contiguous at wing-margin, closing cell R_1.

Abdomen with the caudal margins of the tergites very narrowly and indistinctly yellowish, much less evident than in *sachalinensis*.

Habitat.—Japan (Hokkaido).

Holotype, male, Maruyama, near Sapporo, Ishikari-no-kuni, July 24, 1925 (*S. Kuwayama*). Allotopotype, female; paratopotypes, 2 females.

This interesting fly is named in honor of Prof. Satoru Kuwayama, entomologist of the Hokkaido Agricultural Experiment Station, who has sent me many interesting Tipulidæ from Hokkaido and Karafuto. The most evident points in which the present species differs from *sachalinensis* are the coloration of the head and thorax, the darkened femora, the strongly flavescent wings, and the venation. The abdomen of the unique male type was lost before the hypopygium could be studied.

Cladura bidens sp. nov.

General coloration pale fulvous yellow; tips of the femora and tibiæ narrowly infuscated; abdomen bicolored, the caudal margins of the segments pale, the bases infuscated; male hypopygium only moderately incrassated, the basistyles stout; dististyle single, stout; each gonapophysis produced into two strong teeth at apex.

Male.—Length, about 6.5 millimeters; wing, 8.

Female.—Length, 7.5 milimeters; wing, 9.

Rostrum and palpi obscure yellow, the terminal segments of the latter a little infuscated. Antennæ relatively short, the basal segments yellow, the outer segments weakly bicolorous, the basal portions of the individual segments being a little darker than the tips. Head brownish yellow.

Pronotum yellow. Mesonotum shiny fulvous yellow, the median area of the præscutum a little darker, the lateral margins narrowly yellowish; scutellum and postnotum more infuscated. Pleura yellow. Halteres yellow, the knobs weakly infuscated. Legs with the coxæ and trochanters light yellow; femora and tibiæ brownish yellow, the tips narrowly but conspicuously dark brown; tarsi dark brown, the proximal ends of the basitarsi paler. Wings with a yellowish tinge, the stigmal region still more yellowish; veins dark. Macrotrichiæ relatively long and conspicuous. Venation: Sc_1 ending some distance beyond the origin of R_2, Sc_2 removed from its tip to a distance about equal to m-cu; Rs sinuous; r present, variable in position, usually at or before middistance between the fork of R_{2+3} and the tip of R_1; m a little shorter than the petiole of cell M_1; m-cu at or beyond the fork of M.

Abdominal tergites indistinctly bicolorous, dark brown, the caudal margins of the segments paler; on the sternites this bicolorous appearance is more clearly indicated. In the female the brown of the segments is largly confined to the cephalic and lateral portions, leaving the median area pale as a more or less distinct median stripe. Subterminal segment of male dark brown; hypopygium pale yellowish brown. Male hypopygium (Plate 2, fig. 6) of the general structure of *C. autumna* Alexander, there being a single stout dististyle and the basistyle of moderate length and stoutness. Dististyle, *d*, broadest at base. Gonapophyses, *g*, appearing as flattened, winglike plates, the apex (Plate 2, fig. 8) bearing two powerful forcepslike teeth, the outer margin of the apophysis microscopically setulose. In *autumna* the apical teeth of the gonapophysis (Plate 2, fig. 9) consist of two weak denticles that lie side by side, the cephalic edge of the apophysis with a few weak denticles. The gonapophyses of *C. nipponensis* Alexander (Plate 2, fig. 7) are very different in structure.

Habitat.—Japan (Hokkaido).

Holotype, male, Maruyama, near Sapporo, Ishikari-no-kuni, October 6, 1923 (*M. Hori*). Allotopotype, female; paratopotypes, 5 males and females.

Cladura megacauda sp. nov.

General coloration pale pulvous yellow; tips of femora and tibiæ narrowly infuscated; abdomen bicolorous, yellow, the caudal margins of the individual segments narrowly infuscated;

male hypopygium very large, nearly globular in form, with two dististyles.

Male.—Length, about 7 millimeters; wing, 8.4. Basal segments of the antennæ yellow, the flagellum broken. Head yellow.

Pronotum yellow. Mesonotum shiny fulvous yellow, without markings, the lateral margins of the præscutum paler. Pleura pale yellow. Halteres pale, the knobs darkened. Legs with the coxæ and trochanters pale yellow; femora and tibiæ yellow, the tips narrowly but conspicuously infuscated; basitarsi brown, the tips passing into dark brown, the terminal tarsal segments uniformly dark brown; legs conspicuously hairy. Wings (Plate 1, fig. 7) subhyaline, the costal region very slightly more yellowish; veins dark brown, those in the costal region a trifle paler. Venation: Sc_1 ending just beyond the origin of R_2, Sc_2 about three times its own length from the tip; r atrophied, indicated only by a weak spur on R_2; inner ends of cells R_3, R_5, and 1st M_2 in oblique alignment.

Abdomen yellow, the caudal margins of the segments narrowly infuscated to produce a narrowly banded appearance; basal tergites with a narrow dusky median stripe. Male hypopygium very large, the ninth tergite and sternite fused into a globular structure (Plate 2, fig. 5). Region of the ninth tergite (Plate 2, fig. 4) with a deep V-shaped notch, the extreme apex of the V with a smaller rounded notch; lateral lobes of the tergite thus formed extended into acute points; viewed laterally there are seen to be a second pair of stouter, more obtuse lobes of equal length immediately ventrad of the first pair. Sternal region, *s*, with a very broad V-shaped notch, the margin with abundant, conspicuous yellow setæ. Basistyle, *b*, slender, on the ventro-mesal face of each with two lobes. Two dististyles; outer dististyle, *od*, shorter, fleshy, the inner edge with long erect setæ; inner dististyle, *id*, longer and slenderer, narrowed distally, the basal portion with conspicuous erect setæ, the apex of the style curved.

Habitat.—Japan (Hokkaido).

Holotype, male, Sapporo, Ishikari-no-kuni, end of August, 1925 (*Kuwayama*).

Cladura megacauda is readily distiguished from all known species of *Cladura* by the very large and complicated male hypopygium.

Dactylolabis gracilistylus sp. nov.

General coloration dark gray; præscutum with four brown stripes; pleura clear gray; wings of male strongly infumed; male hypopygium with the long slender basistyle more than twice the length of the outer dististyle.

Male.—Length, 7.2 millimeters; wing, 7.8.

Female.—Length, about 6.8 to 7 millimeters; wing, 7.3 to 7.5.

Rostrum and palpi dark brown. Antennæ black throughout, the basal segment slightly pruinose; flagellar segments oval, very distinctly separated. Head light blue-gray with a small fuscous spot on the anterior vertex from which a capillary vitta extends caudad to the occiput. In the female this capillary line is less clearly defined.

Pronotum brownish gray, clearer gray laterally. Mesonotal præscutum gray with four narrow dark brown stripes; posterior sclerites of mesonotum darker gray. Pleura clear gray. Halteres dark brown, the base of the stem narrowly yellow. Legs with the coxæ light gray; trochanters brown, sparsely pruinose; legs brownish black, the femoral bases only a trifle paler. Wings (Plate 1, fig. 8) with a strong dusky tinge, the stigma and vague seams on the anterior cords still darker; veins dark brown, with conspicuous obliterative areas at the end of Rs and along the cord. Venation: Sc_1 ending immediately before the fork of Rs, Sc_2 at its tip; r at tip of R_1 and just beyond midlength of R_2; petiole of cell M_1 equal to the cell; m-cu at fork of M; arculus punctiform, veins R, M, and Cu being approximated at origin. In the type male, in both wings, veins M_1 and M_2 before the wing margin unite and fuse for a short distance back from the margin, forming an elongate-oval cell M_1. The type of the related *D. longicauda* Alexander, of Japan, exhibits the same peculiarity.

Abdomen of male elongated, dark gray, the hypopygium dark. Male hypopygium (Plate 2, fig. 3) with the basistyles very elongate and slender, more than twice as long as the outer dististyle, the latter nearly straight, stout; inner dististyle slenderer, curved.

In the females that are referred to this species a rather noteworthy difference in coloration from that in the male is found. The femora and tibiæ are light brown with blackened tips. The wings are paler with the brown clouds along the cord more evident. Cell 1st M_2 more elongate; cell M_1 varying from relatively short to more than twice the length of the petiole. Halteres more uniformly pale in color.

Habitat.—China (Che-kiang).

Holotype, male, hills south of Ning-po, May 1, 1925 (*Suenson*). Allotopotype, female; paratopotypes, 1 male, 1 female.

Limnophila (Ephelia) suensoni sp. nov.

Male.—Length, about 6 millimeters; wing, 7. Generally similar to *L.* (*E.*) *dietziana* Alexander (Honshiu, Japan) but notably larger and with differences in coloration and structure of the male hypopygium.

Antennæ with the scape brownish black; basal flagellar segments light yellow, the intermediate segments bicolorous, the bases of the segments being slightly darkened. Præscutal pattern very similar, but the anterior ends of the intermediate stripes subobsolete. The black apical rings of the femora are slightly paler at their extreme tips so that the black annuli appear narrower and subterminal in position. Wings with the same abundant dotted pattern, the apical fascia (in ends of cells R_2 to M_1) tending to be broken into blotches. Venation: The supernumerary crossvein in cell M lies shortly beyond the level of the origin of Rs and opposite the end of vein 2d A. Male hypopygium with the outer dististyle weakly setiferous, as in *dietziana,* but the apical hook short and only gently curved. The differences between the species concerned are shown by the dististyles in figures on Plate 2 (fig. 14, *subaprilina* Alexander; fig. 12, *dietziana* Alexander; fig. 13, *suensoni* sp. nov.).

Habitat.—China (Che-kiang).

Holotype, male, hill south of Ning-po May 1, 1925 (*Suenson*).

This handsome crane fly is named in honor of the collector, Mr. E. Suenson, to whom I am indebted for many species of Tipulidæ from eastern China.

Genus **TROGLOPHILA** Brunetti

1924. *Troglophila* BRUNETTI, Rec. Ind. Mus. **26**: 99–100.
1925. *Esakiomyia* ALEXANDER, Ann. & Mag. Nat. Hist. IX **15**: 73–74.

Brunetti proposed the name *Troglophila* (as a subgenus of *Limnophila*) for a peculiar fly from the Garo Hills, Assam. The following year, I erected the genus *Esakiomyia* for a Japanese species of the same group. There is some question in my mind as to whether the orthopteran genus *Troglophilus* Krauss.,[2] having quite the same derivation, does not preclude the use of *Troglophila* Brunetti, despite the termination. However, until some agreement is reached as to what constitutes a preoccupied name, the genus *Esakiomyia* is placed in the synonymy.

As now constituted, *Troglophila* includes four species, which occur in China, Japan, Assam, and Borneo. These species may be separated by the following characters:

1. m-cu some distance before the fork of M; vein 1st A relatively short, ending opposite the fork of M. (Assam.)...... **cavernicola** (Brunetti).
   m-cu at or close to the fork of M; vein 1st A longer, extending to beyond one-third the length of cell 1st M_2.. 2.
2. Cell M_1 normally present; penultimate and ultimate sections of vein R_1 subequal, or the latter longer. (China.)............. **seticornis** sp. nov.
   Cell M_1 lacking; ultimate section of vein R_1 about one-half the length of the penultimate section.. 3.
3. Sc relatively short, Sc_1 ending opposite the fork of Rs; macrotrichiæ of veins long and conspicuous. (Japan.)........ **filicornis** (Alexander).
   Sc longer, Sc_1 ending between one-third and one-fourth the length of R_{2+3}; macrotrichiæ of veins inconspicuous. (Borneo.)
   monticola Edwards.

Troglophila monticola is known to me only by the proof sheets of Mr. Edwards's paper on the Bornean Nematocera, which was to have appeared in the Sarawak Museum Journal, volume 2, part 4, No. 8, for 1924. Mr. Edwards informs me that the paper had not appeared in press by the middle of 1925. The proof sheet supplies an excellent figure of the wing, indicating a species generally similar to *T. filicornis*, but differing as indicated above. It is probable that the description, when available, will furnish other differences of size, structure, and coloration between the two species.

The generic characters of *Troglophila* may now be recast as follows:

Rostrum very short. Antennæ elongate, filiform, presumably 16-segmented, the suture between the last two segments obsolete or nearly so; scapal segments very small; flagellar segments elongate-cylindrical, clothed with a short erect pubescence and inconspicuous verticils. Anterior vertex broad. Pronotum small and inconspicuous. Mesonotum with the tuberculate pits elongate, approximated or contiguous at the median line, lying slightly anterior to the level of the pseudosutural foveæ. Middle and posterior coxæ closely approximated. Tibial spurs slender. Wings with Sc ending opposite or slightly beyond the fork of Rs, Sc_2 at the tip of Sc_1; r on R_2, far removed from the tip of R_1; cell M_1 present (*seticornis*) or lacking; m-cu before (*cavernicola*) or close to the fork of M; anterior arculus present. Longitudinal veins of wing with macrotrichiæ almost to wing base. Male hypopygium of simple structure; dististyles two. Ovipositor entirely fleshy, the base cylindrical, the tiny tergal valves lying transversely, each terminating in a small spinous point.

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[2] Sitzber. Akad. Wiss. Wien **78**[1] (1879) 533.

Genotype, *Limnophila* (*Troglophila*) *cavernicola* Brunetti (Oriental Region).

Troglophila seticornis sp. nov.

General coloration light brownish yellow; head grayish brown; antennæ of male fully one-half longer than the body; wings with a faint brownish tinge; penultimate and ultimate sections of vein R_1 subequal or the latter a little longer; cell M_1 normally present; m-cu at or close to the fork of M.

Male.—Length, 3.8 to 4.5 millimeters; wing, 5.3 to 5.5; antenna, 6 to 7.

Female.—Length, 4 to 4.5 millimeters; wing, 5.1 to 5.8; antenna, 1.9 to 2.

Rostrum obscure yellow; basal segment of palpus brownish yellow, the remaining segments dark brown. Antennæ setiform, dark brown throughout; in male 15-segmented, the first flagellar segment shorter than the second, the second shorter than the third; beyond the third the segments gradually decrease in length to the end, the terminal segment elongate, approximately as long as the penultimate and probably the result of fusion of two segments. In the female the antennæ are indistinctly 16-segmented, the elongate terminal segment being weakly divided at near two-thirds the length. Head grayish brown.

Pronotum infuscated. Mesonotum light brownish yellow, the lateral margins of the præscutum somewhat paler; pseudosutural foveæ pale. Pleura testaceous yellow, the dorsal pleurites slightly infuscated. Halteres pale brown, the base of the stem narrowly yellow. Legs with the coxæ and trochanters yellowish testaceous; remainder of legs pale brown, the terminal tarsal segments darker. Wings (Plate 1, fig. 9) with a faint brown tinge; veins slightly darker brown. Macrotrichiæ present on all the longitudinal veins beyond the arculus except the extreme bases of M, Cu, and 2d A; Cu_2 without trichiæ as in all known Tipulidæ. Venation: Sc relatively short, Sc_1 ending about opposite one-third the length of R_{2+3}, Sc_2 at its tip; in a few cases Sc is shorter, ending more nearly opposite the fork of Rs; penultimate section of vein R_1 shorter than or subequal to the ultimate section, cell 2d R_1 thus being very deep; cell M_1 normally present, small; in a few cases cell M_1 is lacking but in such instances the tip of vein M_{1+2} is asymmetrical, with usually the anterior of the branches (M_1) preserved, the posterior branch (M_2) being atrophied or with only a marginal trace present; m-cu close to the fork of M; cell 1st M_2 rectangular, gently widened outwardly; cell 2d A broad.

Abdominal tergites dark brown, somewhat paler laterally; sternites obscure yellow.

Habitat.—China (Che-kiang).

Holotype, male, hills south of Ning-po, May 1, 1925 (*Suenson*). Allotopotype, female; paratopotypes, 6 males and females.

TIPULINÆ

Oropeza shirakiella sp. nov.

Female.—Length, 12 to 13 millimeters; wing, 11 to 11.5. Generally similar to *O. candidipes* Alexander (Honshiu, Japan), differing especially in the antennæ and coloration.

Antennæ much shorter. Flagellar segments beyond the first bicolorous, the basal portion of each segment dark brown, the distal portion paler, the terminal segments passing into uniform brown. Præscutum with four stripes; the median vitta of *candidipes* broadly divided by a line of the ground color. Legs with the fore and middle tibiæ strongly infuscated, the narrow base and broader apex of each snowy white; posterior tibiæ entirely snow white; all tarsi white. Wings with the ground color more saturated, especially the costal region which is strongly infumed; prearcular cells largely dark; white prestigmal and poststigmal spots very conspicuous. Abdominal tergites dark brown, the basal rings of the individual segments slightly paler; sternites obscure testaceous yellow, the caudal margins of the segments a little darker.

Habitat.—Taiwan.

Holotype, female, Tamaru (Rato), August 31, 1923 (*T. Shiraki*). Paratopotype, female.

This handsome *Oropeza* is named in honor of Prof. Tokuichi Shiraki, entomologist for Formosa, to whom I am greatly indebted for many kind favors.

Tipula acifera sp. nov.

Belongs to the *annulicornis* group; size very small (wing less than 10 millimeters); antennæ (male) elongate, bicolorous; mesonotal præscutum brownish yellow with three brown stripes, the median stripe paler in front and split by a capillary brown vitta; pleura dark brown; male hypopygium with the median lobe of the tergite cylindrical, gradually narrowed to the blunt tip.

Male.—Length, 8 millimeters; wing, 8.5; antenna, about 4.2.

Female.—Length, 10 millimeters; wing, 9.

Frontal prolongation of the head short, brown, the nasus very short; palpi dark brown. Antennæ elongate in the male, if bent backward extending about to one-third the length of the abdomen; first scapal segment obscure yellow, the second segment light yellow; flagellum bicolorous, the second flagellar segment and those following with the basal enlargement dark brown, the remainder of each segment yellow. In the female the antennæ extend about to the wing root. Head grayish brown, more yellowish anteriorly. In the female the anterior vertex is split by a distinct capillary blackish vitta, the posterior orbits narrowly pale.

Pronotum dark brown. Mesonotal præscutum brownish yellow with three brown stripes, the lateral stripes entire, the median stripe entire only at the caudal end, the anterior end becoming subobsolete, the margins and a capillary median line remaining dark brown; scutum brownish testaceous, the centers of the lobes dark brown; scutellum testaceous, the surface more or less pollinose. Pleura dark brown. Halteres yellow, the knobs dark brown, their apices paler. Legs with the coxæ brown basally, the apices passing into obscure yellow; trochanters obscure yellow; fore femora dark brown, the bases narrowly obscure yellow; middle and hind femora brownish yellow, the tips rather narrowly infuscated; tibiæ and tarsi dark brown. In the female the femora are more extensively and uniformly darkened. Wings (Plate 1, fig. 10) with a faint brown tinge; cells C and Sc slightly darker; stigma oval, dark brown; narrow darker seams along Rs, the cord, and veins R_{4+5}, Cu, and 2d A;

conspicuous obliterative areas before the cord, extending from before the stigma, crossing cell 1st M_2 into the base of cell M_3; a conspicuous pale spot beyond the stigma in cells 2d R_1 and base of R_2; veins dark brown, more yellowish just before the stigma; the veins in the obliterative areas are so pale as to be almost invisible, especially the basal deflection of M_3. Venation: Cell 1st M_2 very small, relatively narrow, m being from one-third to one-half the length of the basal section of M_{1+2}; cell M_1 deep; vein 2d A relatively long, extending to about opposite two-thirds the length of the first section of vein Cu_1.

Abdominal tergites obscure fulvous yellow, the segments margined laterally and caudally with black, the median line of the tergites more or less infuscated, restricting the ground color to the sublateral regions of the sclerites; sternites obscure fulvous yellow, the caudal margins of the segments narrowly ringed with dark brown, the eighth sternite entirely blackened; hypopygium light brown. Male hypopygium with the median region of the tergite produced caudad into a slender blackened cylindrical rod that narrows gradually to the narrow blunt tip.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Ishitsuchi, altitude 1,000 meters, August 10, 1925. Allotopotype, female.

Tipula acifera is allied to *T. insulicola* Alexander, *T. nikkoensis* Alexander, and *T. sparsiseta* Alexander, differing in the small size and structure of the male hypopygium. The fly was included in some interesting species from Shikoku sent to me by Professor Harukawa.

Tipula cylindrostylata sp. nov.

Belongs to the *nipponensis* group; closely allied to *T. querula* Alexander (Japan), differing in the more elongate antennæ and the structure of the hypopygium, especially the feebly notched tergite and the long curved outer dististyle.

Male.—Length, about 11 millimeters; wing, 12.5; antenna, about 4.

Female.—Length, about 12 millimeters; wing, 12.

Frontal prolongation of the head clear light yellow, the palpi beyond the basal segment dark brown; nasus long and slender. Antennæ (male) relatively elongate, if bent backward extending to beyond the base of the abdomen; flagellar segments uniformly blackened. Pleura with the sternopleurite and anepisternum extensively darkened. Wings somewhat darker, the pale areas more clearly delimited, five in number; namely, prestigmal, poststigmal, cell 1st M_2, outer end of cell M, and the outer end of cell 1st A near vein 2d A. Venation: Cell 1st M_2 somewhat smaller.

Abdominal tergites bicolorous, dark brown, the bases of the segments obscure yellow, the amount more extensive on the basal segments, this coloration becoming more restricted behind; basal sternites more uniformly yellow. Male hypopygium (Plate 2, fig. 15) with the ninth tergite, *t*, simple, the caudal margin gently notched. Outer dististyles, *od*, very long and slender, curved mesad, pale throughout, their surfaces with conspicuous erect setæ. Inner dististyles, *id*, viewed laterally simple, the apex produced into an acute point.

Tipula querula has the ninth tergite with a conspicuous U-shaped median notch, the margin of which is blackened, the base untoothed; outer dististyle of moderate length only.

Habitat.—China (Che-kiang).

Holotype, male, hills south of Ning-po, May 1, 1925 (*Suenson*). Allotopotype, female; paratopotype, male.

There can be little question that flies of this general type were the ancestors of *Nesopeza* Alexander, *Mitopeza* Edwards, and through them the remaining Dolichopezaria.

Tipula yamamuriana sp. nov.

General coloration gray, the præscutum with three brown stripes; antennæ bicolorous; wings with a strong brownish tinge; stigma dark brown; pale areas before the cord and including the basal half of cell M; abdominal tergites with brown sublateral stripes.

Female.—Length, 28 millimeters; wing, 23.5. Frontal prolongation of the head dark gray, the nasus elongate; palpi dark brown, the incisures slightly paler. Antennæ with the basal segment elongate, heavily pruinose; second segment brown; flagellar segments bicolorous; first flagellar segment black, obscure brownish yellow at both ends; succeeding flagellar segments black basally, the apical portion brownish yellow, the amount of black gradually increasing outwardly, the terminal segments uniformly infuscated; flagellar segments only moderately incised beneath; verticils conspicuous. Head light gray; vertical tubercle obsolete.

Pronotum light gray. Mesonotal præscutum clear light gray with three brown stripes, the lateral stripes short and narrow, of a paler brown than the median area; median stripe V-shaped, the anterior portion being invaded by an acute triangle of the ground color; scutum gray, each lobe with a single large brown spot; scutellum pale whitish gray; postnotal mediotergite whitish gray, the median area vaguely darkened. Pleura gray, the pleurotergite with a brown spot on the tumid ventral portion. Halteres brown, the base of the stem paler. Legs with the coxæ pale, white pruinose; trochanters obscure yellow; femora reddish brown, the tips passing into black; tibiæ light brown, the tips broadly blackened; tarsi dark brown, passing into black; tibial spurs very slender; tarsi a little longer than the tibiæ. Wings with a strong brownish tinge, the base and cells C and Sc more yellowish; stigmal region very conspicuous, dark brown; whitish subhyaline areas before the cord, including cells 1st R_1, the outer fifth of R, the proximal half of 1st M_2, and the extreme basal portions of cells M_3 and M_4; a second conspicuous pale wash includes the entire basal half of cell M; veins black, brown in the costal region; obliterative areas including the end of Rs, and the basal sections of veins M_{1+2}, and M_3. Venation: Cell R_2 acute at origin, both sections of vein R_2 being approximately in alignment; cell 1st M_2 broad and ample, the cephalic margin gently arcuated; the obliterative sections that surround the cell subequal in length; m and petiole of cell M_1 subequal.

Abdominal tergites dark gray with a broad sublateral brown stripe on either side, the lateral margins broadly, the caudal margins more narrowly, ocherous; the brown sublateral stripes are interrupted or nearly so by the conspicuous blackened impressed basal areas at the sides of the tergites; the gray median area of the tergum begins on the third segment and continues to the end of the abdomen; the brown sublateral stripes become narrowed behind, obsolete on the sixth tergite; sternites brownish gray basally, the outer sternites clearer gray, the caudal margins of the segments narrowly and indistinctly pale. Ovipositor with the basal shields shiny black; valves brownish horn color, all valves smooth; tergal valves slender.

Habitat.—Japan (Honshiu).

Holotype, female, Kurashiki, Okayama-Ken, along a woodland brook, altitude 15 meters, May 27, 1925 (*Harukawa*).

Tipula yamamuriana is apparently most closely allied to *T. kuzuensis* Alexander. It was associated with other vernal crane flies at Kurashiki, especially with *Erioptera* (*Ilisia*) *asymmetrica* Alexander, *Pseudolimnophila inconcussa* (Alexander), *Limnophila* (*Ephelia*) *subaprilina* Alexander, *Tipula nipponensis* Alexander, *T. yamata* Alexander, and *T. aino* Alexander.

The fly bears a rather marked superficial resemblance to *T. aino* but differs in the wide cell 1st M_2 and the conspicuous pale base to cell M.

I dedicate this fly to the memory of Shôzaburo Yamamura, the first native Japanese student of the Tipulidæ. I am indebted to Prof. Teiso Esaki for an account of Yamamura's life, of which a brief summary is given herewith:

Shôzaburo Yamamura was born in either 1893 or 1894 in Minakuchi, Kôga-gun, Province of Omi, of Christian parents. He studied in the Minakuchi Agricultural and Dendrological School and graduated therefrom in March, 1912. During his school days he was one of the leaders of the Minakuchi Boys Entomological Society, founded in 1910, with more than fifty members in various parts of Japan. Upon his graduation, in 1912, he entered Nawa's Entomological Laboratory in Gifu as an entomological assistant. In April, 1915, he moved to the Forestry Institute of Keikidô, Keijô, Chosen, where he died of typhoid fever on December 5, 1915. There can be no question that in the death of Yamamura, Japanese entomology lost one of the most promising of its younger students. Although his early work was devoted to the Lepidoptera, especially the Lithosiidæ, he later had turned his whole attention to the Tipulidæ with the intention of becoming Japan's authority on the group. Only his early decease prevented his attaining this position. Yamamura had amassed a large and valuable collection of Tipulidæ at the time of his death, but this has entirely disappeared. In 1918 and later, through the kind efforts of Dr. Akio Nohira and Professor Esaki, I tried to locate this collection, which, according to Doctor Nohira, included in excess of one hundred species, but this search was unavailing. A portrait of Yamamura is given in the Entomological Magazine (Kyoto) 2 (1916) 64.

ILLUSTRATIONS

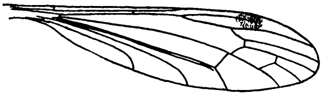
[Legend: *A*, anal veins; *b*, basistyle; *Cu*, cubitus; *d*, dististyle; *dd*, dorsal dististyle; *g*, gonapophysis; *id*, inner dististyle; *M*, media; *od*, outer dististyle; *R*, radius; *Sc*, subcosta; *t*, tergite; *vd*, ventral dististyle. Venational terminology used: Comstock-Needham-Tillyard. Hypopygial terminology used: Crampton.]

PLATE 1

FIG. 1. *Dicranomyia paramorio* sp. nov., wing.
2. *Antocha* (*Antocha*) *confluenta* sp. nov., wing.
3. *Orimargula flavella fuscolineata* subsp. nov., wing.
4. *Erioptera* (*Erioptera*) *harukawai* sp. nov., wing.
5. *Gonomyia* (*Ptilostena*) *kuwayamai* sp. nov., wing.
6. *Gonomyia* (*Ptilostena*) *sachalinensis* Alexander, wing.
7. *Cladura megacauda* sp. nov., wing.
8. *Dactylolabis gracilistylus* sp. nov., wing.
9. *Troglophila seticornis* sp. nov., wing.
10. *Tipula acifera* sp. nov., wing.

PLATE 2

FIG. 1. *Dicranomyia paramorio* sp. nov., male hypopygium.
2. *Antocha* (*Antocha*) *confluenta* sp. nov., male hypopygium.
3. *Dactylolabis gracilistylus* sp. nov., male hypopygium.
4. *Cladura megacauda* sp. nov., male hypopygium, dorsal.
5. *Cladura megacauda* sp. nov., male hypopygium, lateral.
6. *Cladura bidens* sp. nov., male hypopygium.
7. *Cladura nipponensis* Alexander; gonapophysis.
8. *Cladura bidens* sp. nov., gonapophysis.
9. *Cladura autumna* Alexander; gonapophysis.
10. *Cladura autumna* Alexander; tergite.
11. *Molophilus velvetus* sp. nov., male hypopygium.
12. *Limnophila* (*Ephelia*) *dietziana* Alexander; outer dististyle.
13. *Limnophila* (*Ephelia*) *suensoni* sp. nov., outer dististyle.
14. *Limnophila* (*Ephelia*) *subaprilina* Alexander; outer dististyle.
15. *Tipula cylindrostylata* sp. nov., male hypopygium.



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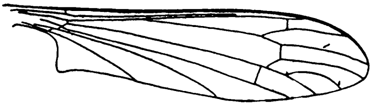

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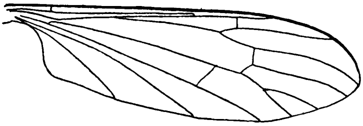

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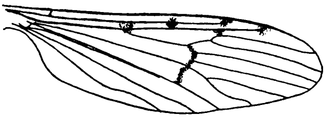

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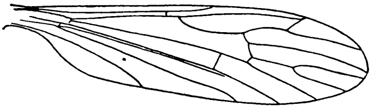

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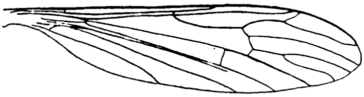

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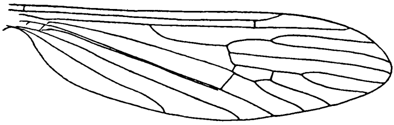

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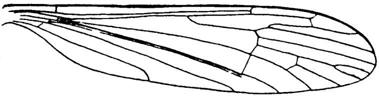

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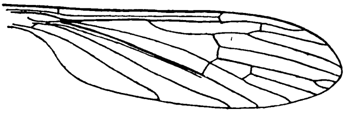

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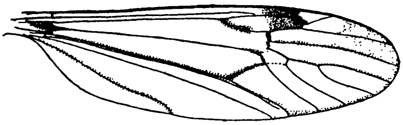

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PLATE 1.

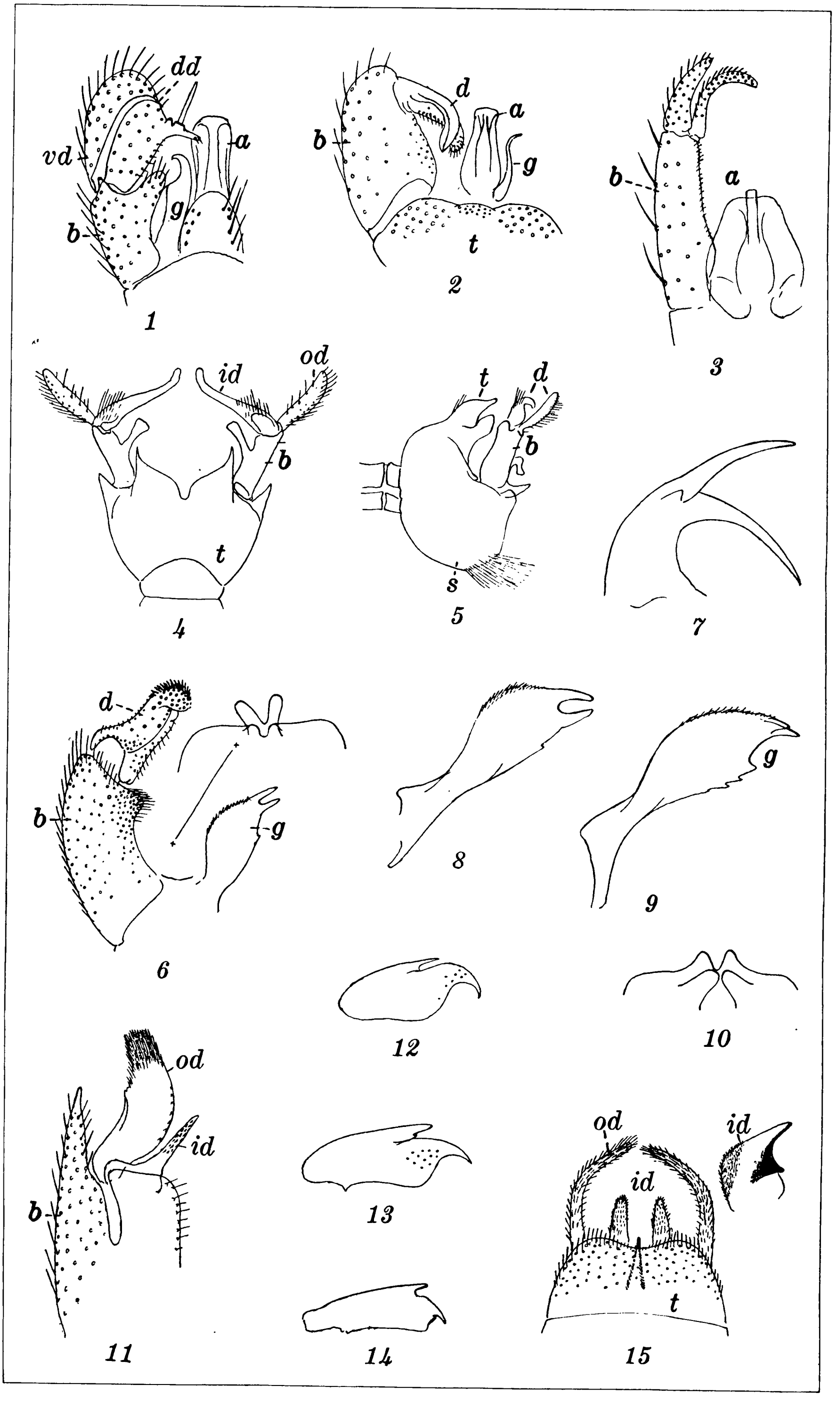
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PLATE 2.

A SUMMARY OF THE PHILIPPINE CATFISHES, ORDER NEMATOGNATHI

By ALBERT W. HERRE
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ONE PLATE

In this paper the Philippine catfishes of the families Plotosidæ and Ariidæ are described. They are recognized at sight by the long barbels, or feelers, borne by the rudimentary maxillaries, and by the absence of scales. There are usually other long feelers, or barbels, around the mouth, snout, or chin, the name catfish being applied because these barbels suggest the whiskers of a cat. The body is covered with thick slimy skin, and many of the Philippine species have bony plates on top of the head. Some of the South American catfishes also have the body more or less completely covered with bony plates. Other distinctive characters are present in the skeleton, but the external characters are enough to distinguish the order. In nearly all catfishes the front of the dorsal and pectoral fins is modified into a strong, sharp, often serrated spine, which moves in its socket with a rotary motion; when erect, the spines are locked so that they cannot be lowered forcibly except by breaking them. If lifted upward and inward with a twisting motion the spine can be lowered. In two North American genera the pectoral spines have a basal poison gland from which venom is injected into the wound made by them. Other catfishes may cause painful injury, due to the jagged wound and the entrance into it of slime, but they are not venomous.

Most of the catfishes have an adipose fin behind the dorsal, as do the fishes of the salmon family.

Catfishes are greedy fishes, and with few exceptions are bottom dwellers, of sluggish habits; they are primarily carnivorous but ready to gobble up anything they can swallow. In other regions occur catfishes of gigantic size, nearly or quite 2 meters in length and 100 kilograms in weight. The Philippine species are mostly small to medium size, only one or two reaching a length of 0.75 meter.

Of the four families found in Philippine waters two have been treated by me in a paper [1], in which full descriptions of the species are given.

Key to the families of Siluroidea occurring in the Philippines.

*a*¹. Dorsal spineless; anal very long.
  *b*¹. Dorsal many-rayed; four pairs of barbels; top of head with bony plates .... **Clariidæ.**
  *b*². Dorsal very short, rudimentary, or even absent; two or three pairs of barbels; no bony plates on head .... **Siluridæ.**
*a*². Dorsal with a sharp-pointed spine.
  *b*¹. Caudal pointed, the long second dorsal and anal confluent with it; no adipose fin .... **Plotosidæ.**
  *b*². Caudal forked, widely separated from the adipose fin and short anal; gill membranes united with isthmus .... **Ariidæ.**

PLOTOSIDÆ

This family of catfishes is readily recognized by the following characters: The first dorsal has a strong sharp spine, and the long, many-rayed second dorsal and anal are confluent with the pointed caudal.

The body is elongate with very tapering tail and depressed head; the first dorsal is above or behind the origin of the pectorals and its spine may be smooth, or serrated on both edges or behind only; there is no adipose fin and the second dorsal is perhaps a forward extension of the caudal; the pectorals may have a strong, sharp-pointed, and barbed spine or a rather weak one; the ventrals have ten or twelve rays; the nostrils are far apart, the front pair usually tubulate, either in the front border of the upper lip and looking up or forward, or perforating it and opening downward; the posterior nostril is a slit behind the maxillary barbel; there are three pairs of barbels, maxillary, mandibulary, and mental or under the chin; a lateral fold at the corner of the mouth may be produced into a short barbel; both jaws with conical teeth, which may be absent in the upper jaw or mixed with molarlike ones in the lower jaw; the vomerine teeth may be molariform or conical, in a patch or a band; the lateral line is more or less conspicuous, the pores far apart; a dendritic organ behind the anus is present in some genera; the gill membranes may be united or more or less separated, and may be free from or partially or completely united with the isthmus.

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[1] Philip. Journ. Sci. 24 (1924) 697–705.

Of the six East Indian genera known, but two occur in the Philippines, one represented by a single species, the other by two. Of the sixteen species recognized by Weber and Beaufort in the Indo-Australian Archipelago eleven belong to the fauna of New Guinea. It is not likely that more than a single additional member of the Plotosidæ will be found in Philippine waters.

Key to the Philippine genera of Plotosidæ.

a^1. Anterior nostrils perforating upper lip and opening downward, with a prominent lip.......... **Paraplotosus.**
a^2. Anterior nostrils tubular, erect or directed forward but never opening downward on underside of lip.......... **Plotosus.**

Genus **PARAPLOTOSUS** (Bleeker) de Beaufort

Paraplotosus BLEEKER, Atlas Ichth. 2 (1862) 100, name only; DE BEAUFORT, Bijdr. Dierk. Afl. 19 (1913) 97; WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) 224.

Body elongate, tapering posteriorly, with depressed head, rounded anteriorly; mouth transverse, with thick lips densely covered with long papillæ and vermiculated folds; the very prominent upper lip perforated near its inner margin by the anterior nostrils, which open downward and have a very prominent lip elongated anteriorly; a maxillary barbel near the end of upper lip, a mandibulary barbel below the corner of mouth, and a pair of barbels on chin between the two mandibulary barbels; eye not covered by skin; first dorsal short, behind origin of pectorals, with four or five rays and a strong spine, toothed before and behind; origin of second dorsal before or above that of ventrals, the latter with twelve or thirteen rays; maxillary teeth conical with rounded tips, in two rhombic patches with rounded sides, the median teeth strongest; teeth in lower jaw in two patches, together forming an arch, very narrow posteriorly; vomerine teeth molar, in a crescentic patch; a very conspicuous dendritic organ between the anus and anal fin; twenty-two gill rakers on the first arch; the second and third gill arches have a series of long cartilaginous processes which cover the base of the gill laminæ on the sides facing each other; the gill membranes confluent in the middle, only the anterior part of the confluent portion joined to the isthmus; branchiostegals nine to eleven.

But one species known.

Paraplotosus albilabris (Cuvier and Valenciennes).

Plotosus albilabris CUVIER and VALENCIENNES, Hist. Nat. Poiss. 15 (1840) 316; BLEEKER, Atlas Ichth. 2 (1862) 99, pl. 96, fig. 1.

Plotosus macrophthalmus BLEEKER, Verh. Bat. Gen. 21[1] (1847) 179.

Copidoglanis albilabris GÜNTHER, Cat. Fishes 5 (1864) 26.

Paraplotosus albilabris WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) 225, figs. 88, 89, and 90.

First dorsal 1–4 or 5; second dorsal 95–110; anal 90–100; pectoral 1–12 or 13; ventral 12 or 13; gill rakers 17+6.

The low elongate body strongly compressed laterally, its depth 6.7 to 7.4 in the length; the broad, blunt head much depressed forward, high posteriorly, 4.75 to 5.4 times in the length, its breadth 1.33 to 1.7 times in its length and 1.3 to 1.45 times in its depth; the wide, bluntly rounded snout 2.45 to 2.6 times in the head; the dorsolateral eyes far apart, looking upward as well as sideways, 4.7 to 5.66 times in the head, 1.8 to 2.3 times in the snout, and 1.1 to 1.5 times in the interorbital, which may be flat or concave; the teeth of the front row in the maxillary long, stout, conical, the others similar but much smaller; the vomerine teeth coarse, rounded, the posterior or fourth row very large, molariform; the teeth in the lower jaw in two patches separated by a deep but rather narrow space, together forming a crescent-shaped band of four rows which becomes one posteriorly; the outer row longest, of large, conical teeth with rounded tips, the others molariform, those of the posterior row largest, short, broad, flat-topped; the nasal barbels longer than any of the others, 1.33 to 1.75 times in the head, but in my specimens they do not reach to the hind border of the operculum or beyond, as stated by Weber and Beaufort; the maxillary and mental barbels twice in the head; the mandibulary barbels longer, reaching beyond gill opening, 1.6 to 1.88 times in the head; first dorsal 1.5 to 1.6 times in the head, its strong spine smooth or toothed, two-thirds the height of the dorsal, 2.5 to 2.6 times in the head; second dorsal high, thick and fleshy in its anterior third, the anal a little lower; the length of the pectoral equals the first dorsal height, its stout spine smooth or barbed before and behind, almost equal to the first dorsal spine; the ventrals extend upon the anal, 1.88 to 2 times in the head.

The color in alcohol uniform chocolate brown, the fins darker to blackish, the underside of the head and the belly brown to white, the lips white.

Here described from a specimen, 280 millimeters long, from Culion; one, 265 millimeters long, from Sitankai; and six fine specimens, 173 to 232 millimeters long, from Bantayan Island.

I have seen many specimens in the fish market at Jolo, Sulu Province, and it seems to be rather common in the southern Philippines.

This marine catfish occurs throughout the East Indies.

Genus PLOTOSUS Lacépède.

Plotosus LACÉPÈDE, Hist. Nat. Poiss 5 (1803) 129.

Vernacular names.—English, catfish; Bikol, iito; Ilokano, nito; Samal, tauti; Tao Sug, bak'c and tauti; Visayan, iito; Visayan of Siquijor, parigas.

The elongate body strongly compressed laterally, the head depressed anteriorly, bluntly rounded; the thick lips covered with papillæ or small folds; the prominent upper lip perforated by the anterior nostril which opens upward as a short tube; the barbels as in *Paraplotosus;* the eyes not covered by skin; the teeth of the upper jaw conical, in a narrow, rectangular band; those in the mandible are mixed with molar teeth and form a semilunate band; the molariform vomerine teeth are in a crescentic band; first dorsal short, behind the origin of the pectorals, with four or five rays and a strong spine denticulated before and behind; second dorsal begins between the origin of the ventrals and anal; the pectoral spine toothed; the lateral line well developed; twenty to twenty-eight gill rakers on the entire first branchial arch; the gill membranes are free from the isthmus, nearly totally separate at the middle; a conspicuous dendritic organ between the anus and anal; branchiostegals nine to twelve.

These catfishes are well and unfavorably known to fishermen, as their jagged spines inflict severe wounds. I regard them as marine fishes which, though they stray into estuaries and rivers, never go far from the sea. Of the four or five species of this Indo-Pacific genus two occur in the Philippines.

Key to the Philippine species of Plotosus.

a^1. Nasal barbel extending beyond eye; dorsal 130 to 140; anal 106 to 118; uniform brown; teeth of lower jaw in four or five rows. **P. canius.**

a^2. Nasal barbel not reaching beyond rear margin of eye; dorsal 80 to 100; anal 70 to 80; lower jaw teeth in two or three rows; color brown or with two white longitudinal bands.................... **P. anguillaris.**

Plotosus canius Buchanan Hamilton.

Plotosus canius BUCHANAN HAMILTON, Fishes Ganges (1822) 142; CUVIER and VALENCIENNES, Hist. Nat. Poiss. 15 (1840) 315; BLEEKER, Atlas Ichth. 2 (1862) 99, pl. 96, fig. 2; GÜNTHER, Cat. Fishes 5 (1864) 25; DAY, Fishes of India (1878) 482, pl. 112, fig. 3; WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) 227.

Plotosus unicolor CUVIER and VALENCIENNES, Hist. Nat. Poiss. 15 (1840) 315.

Plotosus viviparus BLEEKER, Arch. Ned. Ind. 3 (2) (1846) 182.

Plotosus horridus BLEEKER, Arch. Ned. Ind. 3 (2) (1846) 183.

Plotosus multiradiatus BLEEKER, Arch. Ned. Ind. 3 (2) (1846) 183.

First dorsal 1–4 or 5; second dorsal 130 to 140; anal 106 to 118; branchiostegals 11 to 13.

The laterally compressed, elongate body tapers to a point posteriorly, its depth 7.1 to 7.9, its head 4.5 to 4.7 in the length; the very broad head depressed anteriorly, with a broad blunt snout; the breadth of the head 1.25 to 1.35 in its length and 1.8 times its depth; the snout 2.8 to 2.85 times in the head; the small dorsolateral eyes look up as well as to the side, 7.1 to 10.4 times in the head, 2.45 to 3.75 times in the snout, and 2.2 to 3.2 times in the flat interorbital; the teeth in the upper jaw small, in three rows; the teeth on the palate are in a crescentic band, the posterior ones largest; the band of teeth in the lower jaw divided by a median toothless space, the teeth in four rows; the dorsal and pectoral spines equal or nearly equal in length, about 2.8 times in the head, smooth or granulate in front except at the upper part; this and the posterior edge are serrate, the point very sharp; the first dorsal and pectoral each a little shorter than snout and eye together, or 2.12 to 2.14 times in the head; the short triangulate ventrals do not reach the anal in the young, but extend beyond its origin in adults, shorter than the snout, 3 times or a trifle more than 3 times in the head; the nasal barbels extend far beyond the eye and may extend beyond the head almost to the base of the dorsal spine. Weber and Beaufort state that the maxillary barbels are longer than the nasal, but in my specimens they are shorter; the mandibulary barbels extend a little beyond the gill opening; the mental barbels are much shorter; gill rakers 17 + 7 or 18 + 6.

The color in alcohol deep chocolate brown above, paler brown below, very much lighter under the head; the second dorsal and anal dark brown, edged with black.

Here described from a specimen, 150 millimeters long, from La Paz, Iloilo, taken in brackish water, and a specimen, 340 millimeters long, from Tacloban, Leyte.

This species occurs in rivers and in the sea; it ranges from Ceylon, Bengal, and the Andamans to New Guinea and the Aru Islands. According to Hamilton it is "often found three feet long and sometimes between four and five." It is considered excellent food. It seems to be very rare in the Philippines, but may have been merely passed by for *Plotosus anguillaris.*

Plotosus anguillaris (Bloch).

Polystacus anguillaris BLOCH, Ichty. 11 (1797) 49, pl. 373, figs. 1 and 2.

Plotosus ikapor LESSON, Voy. Coquille, Zoologie, Poisson 2 (1830) 132, pl. 31, fig. 3.

Plotosus marginatus BENNETT, in Life of Raffles, Cat. Zool. (1830) 691.

Plotosus lineatus CUVIER and VALENCIENNES, Hist. Nat. Poiss. 15 (1840) 306.

Plotosus anguillaris CANTOR, Journ. Asiat. Soc. Bengal 18 (1850) 1246; GÜNTHER, Cat. Fishes 5 (1864) 24; MEYER, Ann. Soc. España Hist. Nat. 14 (1885) 41; GÜNTHER, Fische der Südsee 3 (1909) 372; JORDAN and SEALE, Bull. Bur. Fisheries 26 (1907) 8; EVERMANN and SEALE, Bull. Bur. Fisheries 26 (1907) 56; SEALE and BEAN, Proc. U. S. Nat. Mus. 33 (1907) 239; JORDAN and RICHARDSON, Bull. Bur. Fisheries 27 (1908) 242; WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) 229; FOWLER, Proc. U. S. Nat. Mus. 62 (1922) 3.

Plotosus castaneoides BLEEKER, Nat. Tijds. Ned. Ind. 2 (1851) 490.

Plotosus arab BLEEKER, Atlas Ichthy. 2 (1862) 98, pl. 95, fig. 2; DAY, Fishes of India (1878) 483, pl. 112, fig. 4.

First dorsal 1–4 or 5; second dorsal 80 to 100; anal 70 to 77; branchiostegals 12.

The trunk is laterally compressed, its posterior half very much so, and tapers posteriorly to a point, the depth 6.5 to 7.6 times in the length; the large head moderately depressed anteriorly, 4 to 4.25 times in the length, its breadth two-thirds to three-fourths its length and 1.4 to 1.6 times its depth; the long, bluntly rounded, projecting snout 2.3 to 2.6 times in the head; the small lateral eyes 2.3 to 2.8 times in the snout, 1.8 to 3.66 times in the interorbital, and 6 to 10 times in the head; the nasal barbels may scarcely reach the eye or may extend to its hind margin; all the barbels are about the same length; the stout, coarse, conical teeth in the upper jaw are in a crescent-shaped band, of two rows centrally, one at the sides; in large specimens the central teeth become irregular and may appear in three rows; the teeth on the vomer are coarse, blunt, cylindrical, in a crescentic band of three rows centrally, the posterior median ones much the largest; the teeth on the lower jaw in two rows, sometimes with a third partial row between them, becoming one row laterally, the anterior and lateral teeth strongest, blunt or somewhat hooked in larger specimens; first dorsal 1.7 to 1.8 times in the head, its spine serrated before and especially behind, 1.5 to 1.8 times in the height of the fin and 2.6 to 3.2 times in the head; the pectoral nearly or quite equal to the first dorsal, its spine like the dorsal spine in height and barbs; the ventrals small, not reaching the anal or extending beyond its origin, 2.7 to 3.2 times in the head; the number of gill rakers seems to be variable; I find 21 + 8, 23 + 8, 22 + 7, and 21 + 6.

The color in alcohol varies from blackish brown or chocolate to light reddish brown, paler to whitish beneath, the lips white; a white stripe begins on the tip of the snout and extends back on top of the head and along the side below the dorsal to the caudal; another white stripe begins at the angle of the mouth and runs back along the side, stopping some distance before the caudal; with advancing age one or both of these stripes disappear; the fins are all grown, the second dorsal, anal, and caudal with a black edge.

The Bureau of Science collection contains the following Philippine specimens, ranging in length from 10 to 260 millimeters:

Puerto Galera	15
San Miguel Bay, Camarines Sur Province	2
Bacon, Sorsogon Province	1
Iloilo	1
Estancia, Iloilo Province	1
Siquijor	11
Bantayan Islands	4
Cabalian, Leyte	49
Busuanga	6
Culion	60
Dinagat	8
Camiguin	2
Caldera Bay, Zamboanga Province	8
Zamboanga	21
Davao	1
Samal Island, Davao Gulf	1
Jolo	6
Pearl Bank	132
Sitankai	4
Sibutu	10

This list is a very incomplete representation of the distribution of *Plotosus anguillaris* in the Philippines. There are no specimens from Manila, though the fish is common in the market there, and in fact throughout the Islands. Schools of young, 10 to 160 millimeters in length, swarm about the coral reefs. Vast numbers occur about every coral reef in the Sulu Archipelago; they apparently remain in schools until rather large. Many times I have dislodged schools numbering several hundred individuals from holes in coral masses or under rocks. At Sibutu and about Tawitawi I often caught several hundreds at once. The fish is very good to eat.

Eydoux and Souleyet were the first to collect this fish in the Philippines, at Manila, as listed by Valenciennes; Günther had a specimen from the "Philippine Islands;" Jordan and Seale had specimens from Manila; Evermann and Seale from Bacon, Sorsogon Province, and Jolo; Seale and Bean from Zamboanga; Jordan and Richardson from Cuyo; and Fowler from Cebu and Zamboanga.

From foreign countries the Bureau of Science collection has excellent specimens from Japan; Amoy and Hongkong, China; Sandakan, British North Borneo; and Lord Howe Island.

This is a fish of exceedingly wide range; it occurs from the Red Sea to Zanzibar and Madagascar at the west, eastward to the Samoan and Society Islands in the Pacific, and north to Japan. All the specimens I have seen came from salt or brackish water.

ARIIDÆ

The short dorsal fin has a long sharp spine and seven rays and is placed forward, between the pectorals and ventrals, the latter with six rays; the adipose fin is shorter than the dorsal, opposite the anal, which has fourteen to twenty-six rays; the pectorals are low down, each with a long sharp spine; the caudal is deeply forked; the head is usually depressed or may be conical, and may be covered with skin or with conspicuous bony plates; the nostrils are close together, the posterior one with a valve but not a barbel; usually maxillary, mandibulary, and mental barbels are present; sometimes only maxillary or only mandibulary barbels are present; the mouth is large or small, transverse or crescent-shaped, usually inferior; the teeth on the palate may be villiform, conical, granular, or wanting; on the jaws they may be villiform, conical, or incisorlike, in one or more rows, or in bands or patches; the eyes usually have a free orbital margin, but may be subcutaneous; the gill membranes are united and connected with the isthmus; branchiostegals five to nine.

A large group, represented by only two genera in the Philippines, the species often very difficult to distinguish. The palatal teeth have been used to separate species and to distinguish genera and subgenera. Owing to the great uniformity of color and general appearance of many of the species, the teeth are of fundamental importance in diagnosis, but they are of little worth ofttimes unless one has a series of specimens for examination. The shape and arrangement of the patches of palatal teeth vary much with age; in young stages they may be almost entirely lacking or represented by a few widely separated tiny teeth which later coalesce into large uniform patches. For this reason I cannot recognize such genera as *Netuma, Ariodes, Pseudarius,* etc. Common in shallow bays, estuaries, rivers, and lakes.

Key to the Philippine genera of Ariidæ.

*a*¹. Teeth present on palate.. **Arius.**
*a*². No teeth on palate.. **Hemipimelodus.**

Genus **ARIUS** Cuvier and Valenciennes

Arius CUVIER and VALENCIENNES, Hist. Nat. Poiss. 15 (1840) 40.

Vernacular names.—English, catfish; Bikol, tabañgoñgo; Ilokano and Tagalog, kanduli; Tao Sug, gagu'k; Visayan, tambañgoñgo and tabanko.

The elongate body more or less laterally compressed, especially posteriorly; the top of the head always has more or less well-developed bony plates with smooth, granular, or rugose surface; on the nape is a large, variously shaped bony plate, the occipital process, its surface likewise smooth, granular, or folded; behind it, usually touching and more or less encircling the base of the dorsal spine, is a bony plate with smooth or rough surface; on the forward part of the top of the head is a median elongate and variously shaped fontanelle, sometimes with secondary lateral ones; snout depressed, upper jaw more or less projecting, mouth moderate to large, straight or curved; the jaw teeth very sharp, villiform, in bands which are entire or divided at the middle and more or less curved, rarely straight; the teeth on the palate may be villiform, conical, granular, or molariform, in one, two, or three groups on each side; the lateral or slightly dorsolateral eyes have a free margin; the gill membranes have a free posterior margin.

A large and difficult genus, the Philippine species apparently not numerous, but several more may be expected when southern waters have been more carefully explored. Owing to the fact that many of the species show great similarity in color and general appearance, the teeth are of fundamental importance in diagnosis, but often they are of little worth unless one has a series of specimens for examination. The shape and arrangement of the patches of palatal teeth vary greatly with age in some species; in very young stages they seem to be entirely lacking; they make their first appearance in small patches of a few widely separated teeth, which later coalesce into larger uniform patches typical of the species; sometimes patches normally distinct fuse more or less, usually not losing their identity but at times melting into one with no trace of the original component unit patches.

The species abound in shallow bays and estuaries, and also in fresh-water rivers and shallow muddy lakes. Some of the Philippine species occur in both fresh and salt water; some are thus far known only from the sea; and at least one species, *A. magatensis*, seems to be confined to fresh water.

Though not of first-rate quality, and by no means to be classed with such a choice gastronomic tidbit as the channel catfish of eastern North America, *kanduli* make very acceptable chowder or *gulai*. Immense quantities are caught in shallow bays by means of *baklad*, or fish corrals, and great numbers are captured in Laguna de Bay with traps, nets, and long lines.

Every year, sometimes twice in one year, an epidemic of "red water," due to inordinate quantities of *Peridinium* or some flagellate protozoan, recurs in Manila Bay and causes great mortality among the fishes. Occasionally this happens in Pasig River and the esteros of Manila, or in the great Laguna de Bay. Kanduli seem to be more susceptible to this than other fishes are, and incredible numbers are killed in Laguna de Bay and Pasig River, so that for days tens of thousands float on the surface, their putrid bodies tainting air and water.

The genus is intertropical in its distribution. In many species the males have a very singular mode of incubating the eggs by carrying them in the mouth until hatched. The eggs are few in number and very large, comparatively speaking. Manifestly eating and this strange domestic habit are incompatible.

In the following key are given in square brackets several species listed by authors, apparently on the authority of Gogorza y Gonzalez and Casto de Elera; the identifications in these compilations cannot be accepted unless substantiated by competent Dutch, English, French, or German ichthyologists. I have therefore given no descriptions of these doubtful species.

Key to the species of Arius reported from the Philippines.

a^1. Teeth on the palate granular or molariform.

b^1. Teeth in four groups (*Ariodes* Bleeker).

c^1. Posterior patches in a broad oval or ellipse, converging behind or parallel.

d^1. Anterior patches well developed.

e^1. Forward patches ovate-elliptical, far apart, each of sixteen to twenty-six or more teeth, their length parallel to front margin of palate; posterior patches far back, elliptical, usually parallel; occipital process a truncate triangle with nearly straight sides; gill rakers twelve........................ **A. magatensis.**

e^2. Forward patches ovate, nearly at right angles to anterior palatal margin; posterior patches pear-shaped, converging behind; occipital process triangular, elevated along the center, sides convex; gill rakers nine.................... **A. crossocheilus.**

d^2. Anterior patches very small or rudimentary; occipital process with straight sides; gill rakers seven or eight. [*A. argyropleuron.*]

c^2. Posterior patches elongate or in a narrow oval, ending at the rear in diverging points.

f^1. Occipital process ovate or oval, large, elevated, with convoluted rough surface; gill rakers eight or nine. **A. leiotetocephalus.**

f^2. Occipital process triangulate, with straight sides, the surface radially granulate; gill rakers twelve............ **A. goniaspis.**

b^2. Teeth in two groups (*Pseudarius* Bleeker).

g^1. Teeth beginning at front margin of palate and covering most of its anterior surface, the patches broadest anteriorly; gill rakers twelve.. **A. manillensis.**

g^2. Teeth far back on palate in semioval patches; gill rakers fourteen .... [*A. maculatus.*]

a^2. Teeth on the palate not granular or molariform.

h^1. Teeth on the palate strong, coarse, conical with pointed ends; two small ovate-triangulate, widely separated patches on the palatine bones; rest of palate smooth; gill rakers twelve. **A. dispar.**

h^2. Teeth on the palate villiform in three groups on each side, forming a pair of subtriangular patches, their bases forward; gill rakers nine (*Netuma* Bleeker).. **A. thalassinus.**

Arius magatensis sp. nov. Plate, 1, fig. 1.

Anal 20 or 19; pectoral 1–11.

Body elongate, slender and strongly compressed laterally on the posterior half, the depth 5.1 to 5.3 times in the length; head 3.35 to 3.6 times in the length, its dorsal profile convex from the base of the dorsal to the tip of the depressed snout, its breadth 1.45 to 1.5 times in its length and 1.4 to 1.66 times its depth; the plates on top of the head granulose, with a very long median fontanelle beginning on the snout opposite the space between the nostrils and broadening out to beyond the eyes, then narrowing to a long triangular slit which does not extend to the occipital process; this is a truncate triangle with nearly straight sides, granulose and keeled, the base somewhat expanded; the basal bone of the dorsal spine lunate, narrow, granulose, short; the humeral process triangular, its surface granular; the projecting snout somewhat angulate and pointed centrally, 2.58 to 3 times in the head; eye elliptical, its margin free, 5.6 to 6.9 times in the head, 1.8 to 2.65 times in the snout, and 2.5 to 3 times in the interorbital; the maxillary barbel extends to the posterior margin of the head or the base of the pectoral; the mandibulary barbel 0.7 as long as the maxillary, and the mental barbel 0.45 to 0.47 as long; upper lip projecting, partially exposing the upper band of teeth, the inner margin of the lips finely rugose; the teeth in the upper jaw villiform, in a narrow arched band, its breadth 4 to 4.4 times in its length; the lunate band in the lower jaw divided at the middle by a conspicuous septum, longer than the upper band, widest at the middle and tapering to a point at the outer ends; on each side at the forward outer angle of the palate is an ovate-elliptical patch of granular teeth, sixteen to twenty-six or more in number, its long axis parallel with that of the anterior margin of the palate and equal to the diameter of the pupil; far back on the palate is a pair of somewhat elliptical patches of coarse granular teeth, their long axes either parallel or slightly converging behind and equal to or longer or shorter than the eye; the dorsal fin 1.1 to 1.2 times the depth, longer than the head without the snout, 0.71 to 0.83 of the head, its spine moderately strong, sharp-pointed, granulose anteriorly, smooth behind, 1.6 to 1.8 times in the head; the pectoral 0.66 to 0.72 of the head, its flattened spine equal to or a little shorter than the dorsal spine, its outer and inner margins varying from slightly roughened to finely but strongly serrate; the base of the adipose fin 1.75 to 2 times in that of the anal, and about 4 times (3.87 to 4.3) in the distance to the dorsal; the caudal deeply lobate, the upper lobe longest; the broad ventrals do not reach the anal, their length equal to or a little more than the base of the anal, 1.7 to 2 times in the head; gill rakers 12 + 6, the longest equal to the pupil and a little more than half the length of the gill filaments; the conspicuous lateral line begins beneath the dorsal, varying from the anterior to the posterior end of its base.

The color in alcohol is bluish to dark chocolate brown above, darkest on top of the head, the sides paler, reddish plum to whitish or yellowish below, with a silver luster all over the sides; cream color or white beneath; the fins vary from chocolate to red-brown, the caudal palest.

Here described from six specimens, 190 to 268 millimeters in length. They are part of a large number collected by me in a deep pool in Magat River at Bagabag, Nueva Vizcaya Province; owing to lack of containers I was unable to bring away more. Some of those caught were half a meter or more in length.

This species is abundant in the upper Cagayan Valley, in Cagayan River and its larger tributaries. One of the specimens caught, a male, had his mouth full of large eggs, twelve or fifteen in number, which he was incubating after the well-known maner of many Ariidæ. This was on April 28.

Arius crossocheilus Bleeker. Plate 1, fig. 2.

Arius crossocheilus BLEEKER, Arch. Ned. Ind. 3 (2) (1846) 137.

Arius crossocheilus WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) 276, fig. 107.

Arius tonggol BLEEKER, Arch. Ned. Ind. 3 (2) (1846) 292; GÜNTHER, Cat. Fishes 5 (1864) 164; MEYER, Ann., Soc. España Hist. Nat. 14 (1885) 41.

Ariodes tonggol BLEEKER, Atlas Ichthy. 2 (1862) 39, pl. 57.

Anal 18; pectoral 1, 11.

Body elongate, the depth about 5, the head 3.5 times in the length; the head much wider than deep, its breadth about two-thirds its length; the granulated occipital process triangular, somewhat longer than its basal width, elevated mesially and less than twice as long as its width at the middle, its sides convex, the posterior margin touching the basal bone at the foot of the dorsal spine; this bone is narrow, with winglike ends, and is granulated above; on young specimens the occipital process is narrow and strongly keeled; the median fontanelle begins on the snout, ends before the occipital process, and is broadest in the middle; the dorsal profile slopes down in a straight line to the somewhat conical, rounded, slightly prominent snout; the eyes are 5 to 6 times in the head, placed about the middle of the head; the orbital margin free; in the young the eye is less than twice, in adults more than twice in the snout, and nearly 3 times in the interorbital space; the maxillary barbels extend on the pectorals in the young, in old specimens not quite to the pectoral base; the mandibulary barbels reach the hind border of the gills, the mental barbels are shorter; both jaws have sharp villiform teeth in an arcuate band; the coarse granular palatal teeth are in four separate patches; there are two small, widely separated patches on the front of the palate and posteriorly two large, pear-shaped patches, their long axes converging behind; the anterior patches are about half the size of the eye; the height of the dorsal is more than two-thirds the length of the head; its spine nearly equal to the head without the snout, its front border granular below, serrated above and behind; the pectoral equals the dorsal, its flattened spine serrate on both margins, stronger than the dorsal spine and equal to it in length; the ventrals do not nearly reach the concave anal; the base of the small adipose fin is from 5 to more than 6 times in the distance to the dorsal; there are about nine stiff, somewhat flattened gill rakers, much shorter than the gill filaments.

The color is bluish brown above, silvery white below, the fins yellowish with more or less distinct dusky margins.

Meyer reported this species from Laguna de Bay, and it has been listed from various Philippine localities by Spanish authors. It may well occur here, but I have seen nothing approximating it among the thousands of specimens observed from Laguna de Bay and Manila Bay.

The above description is after that of Weber and Beaufort. This is a marine species, known from Java to Celebes. As it has not been reported elsewhere from fresh water I look upon the Laguna de Bay record with suspicion.

Arius leiotetocephalus Bleeker. Plate 1, fig. 3.

Arius leiotetocephalus BLEEKER, Nat. & Geneesk. Arch. Ned. Ind. 3 (2) (1846) 292; WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) fig. 112.

Arius meyenii MÜLLER and TROSCHEL, Horae Ichth. 3 (1849) 9.

Ariodes leiocephalus BLEEKER, Ichth. Arch. Ind. Prodr. I Siluri (1858) 88; Atlas Ichth. 2 (1862) 40, pl. 60, fig. 2.

Arius liocephalus GÜNTHER, Cat. Fishes 5 (1864) 165.

Anal 15–17; pectoral 1–12–13.

Body elongate, thick, laterally compressed, the depth 4.4 in the length (4.66 to 5.25, according to authors); the head is 3 times (3.2 to 3.66, according to authors) in the length, its breadth over a tenth more than its depth and 1.5 times in its length; the occipital process is large, ovate, elevated centrally and anteriorly, its surface rough with convoluted ridges, its breadth 1.3 times in its length, fitting closely against the narrow basal bone of the dorsal spine; the top of the head smooth, with a long narrow median fontanelle beginning close to the occipital process and running forward upon the snout, the dorsal profile descending in a long straight incline of about 30° to the tip of the snout; the broad snout expanded laterally and upward between the eyes and nostrils, its blunt tip broadly rounded, projecting beyond the inferior mouth; the eye is 7.2 times in the head, 3.85 times in the interorbital space, its margin free; the maxillary barbels reach nearly or quite to the rear margin of the opercle; the mandibulary barbels are about two-thirds, the barbels near the tip of the chin a little more than half as long; the inner margin of the upper lip is crenate-lobulate, the lower lip covered with transverse corrugations; the teeth in the upper jaw are in a single curved band, villiform, very sharp; some distance behind are two small, widely separated oval patches, placed obliquely, and beyond these are two additional elongate patches, broad anteriorly, ending posteriorly in narrow, long-drawn-out, diverging points; the sharp villiform teeth of the lower jaw are in a narrow band, separated in two parts by a median toothless space; the humeral process smooth, triangular; the dorsal fin nearly equal to the depth, its stout spine covered with coarse granulations anteriorly, its posterior side smooth or nearly so, its length nearly two-thirds that of the head (two-thirds or three-fourths, Auctt.); the base of the small adipose fin is 3 times in that of the anal, about 7 times in the distance between its origin and the insertion of the dorsal; the pectoral is two-thirds the length of the head, the flattened spine equal to that of the dorsal, serrated before and behind; the caudal is deeply lobate; eight or nine short, stiff, flat gill rakers.

The color in alcohol is reddish brown with a metallic silvery sheen, the underside cream to bluish white; thickly sprinkled on the belly with minute violet-brown ocellated specks; the fins dusky yellowish.

Here described from a specimen, 284 millimeters long, collected by me in San Miguel Bay, Camarines Sur Province, Luzon, where it was being caught in large quantities in baklad. I also collected two specimens, 185 and 240 millimeters long, at Tacloban, Leyte. Professor E. C. Starks, of Stanford University, collected a specimen, 370 millimeters long, in the Manila market, in August, 1926.

A marine and estuarine species, known hitherto from Malacca and Singapore to Celebes.

Arius goniaspis Bleeker. Plate 1, fig. 4.

Arius goniaspis BLEEKER, Act. Soc. Indo-Neerl. 3 (1858) 44; GÜNTHER, Cat. Fishes 5 (1864) 166; WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) 283.

Ariodes goniaspis BLEEKER, Ichth. Arch. Ind. Prodr. I Siluri (1858) 91; Atlas Ichth. 2 (1862) 42, pl. 60, fig. 1.

Anal 17; pectoral 1–11.

Body elongate, the depth 5.2 times, the head 3.3 times in the length; the breadth of the head 1.4 times its depth and two-thirds of its length; the profile slightly convex, depressed anteriorly, the head granulated above, the occipital process triangulate, the lateral margins nearly straight just as in Bleeker's figure, expanded basally, about as wide as long, more or less radially granulate, with a central keel, the slightly notched hind margin touching the short, granulate, curved bone before the base of the dorsal spine; the median fontanelle begins opposite the hind margin of the posterior nostril and widens to beyond the eye, then narrows and continues back to a point opposite the posterior angular tip of the preopercle; the small humeral process is sharply triangular, its surface rugose; the projecting snout is broadly rounded, depressed, convex, 2.6 times in the head; the eye is obliquely placed, elongate, with vertical pupil, 2.4 times in the snout and 2.7 times in the broad interorbital; the mouth is moderate, the upper jaw projecting so that the teeth are exposed when the mouth is closed; the sharp villiform teeth in the upper jaw are in a curved band, its length 4.5 times its breadth; the teeth in the lower jaw are in a longer band, widest centrally and tapering posteriorly, divided in two parts by a narrow symphysial interspace; the conical, coarsely granular, palatal teeth are in two groups on each side, a small ovate patch at the outer margin anteriorly, and an elongate patch posteriorly, the two latter divergent; on the left side the two patches have coalesced in my specimen to form a single, large, curved patch; the maxillary barbel reaches to the posterior extremity of the head in my specimen; the mandibulary barbel reaches almost to the base of the pectoral, 1.5 times in the length of the maxillary barbel; the mental barbel much shorter, 2.4 times in the maxillary barbel; the dorsal 1.3 times the depth and nearly 1.2 times in the head; the dorsal spine 0.9 the depth, 1.75 times in the head, its anterior margin rugose, becoming barbed near the apex, its posterior margin barbed; the adipose fin small, its base about 4 times in the distance to the posterior end of the dorsal base, 1.75 times in the base of the anal; the pectoral 1.46 times in the head, its spine equal to that of the dorsal, with similar rugosities and toothed barbs; the ventrals short, not reaching the anal, twice in the head; the upper lobe of the deeply notched caudal is the longer; the lateral line conspicuous, its origin opposite the dorsal spine; the axillary pore moderately conspicuous; the slender gill rakers 12 + 8, the longest about 2.2 times in the eye.

The color in alcohol is chocolate brown on the head, gradually becoming paler posteriorly along the back, whitish below the lateral line, the sides of the head passing into reddish brown and whitish, all with a silvery luster, except along the median dorsal region of head and back; white beneath; the dorsal and pectorals blackish, more or less hyaline marginally; the adipose fin blackish basally or reddish brown by transmitted light, becoming clear marginally; the caudal reddish brown basally, with a silver sheen, the rays yellowish brown, becoming clear posteriorly; the anal brownish basally, clear posteriorly; the ventrals white beneath, somewhat dusky above along the outer basal region.

Here described from a specimen, 208 millimeters long, obtained by me in the Manila market and said to come from Laguna de Bay. I recently found in the Manila market a specimen, 320 millimeters long, which I refer here. In it the two palatal patches on each side have coalesced to form but one.

Previously known from two specimens, 100 and 113 millimeters long, obtained by Bleeker in Sumatra.

Arius manillensis Cuvier and Valenciennes. Plate 1, fig. 5.

Arius manillensis CUVIER and VALENCIENNES, Hist. Nat. Poiss. 15 (1840) 69.

Rita manillensis GÜNTHER, Cat. Fishes 5 (1864) 94; JORDAN and RICHARDSON, Check List Phil. Fishes (1910) 13.

Pseudarius philippinus SAUVAGE, Bull. Soc. Philomat. IV 7 (1880) 226.

? *Arius falcarius* MEYER, Ann., Soc. España Hist. Nat. 14 (1835) 41.

Anal 18, in one specimen 17; pectoral 1–10.

The elongate body laterally compressed, the posterior half much so, the depth 4.6 times, the depressed head 3.1 to 3.3 times in the length, its width about 1.4 times in its length and 1.33 to 1.48 times its depth; the plates on top of the head granulose, with a very long median fontanelle beginning on the snout opposite the posterior nostril and extending as a broad, shallow, sub-triangulate depression beyond the eyes, then narrowing to a slit which continues nearly to the occipital process; this is subtriangular, with a widely expanded base about equal in width to the length of the process; the basal bone of the dorsal spine narrow, short, its surface granulate; the humeral process nearly triangular, smooth, or its lower margin somewhat granular; the dorsal profile describes a very gentle curve from the base of the dorsal to the tip of the strongly projecting, broad, blunt, slightly rounded snout; the eye elliptical, slightly oblique, its margin free, the ovate pupil vertical, 3 times in the interorbital, 2.5 to 2.8 times in the snout, and 6.4 to 6.72 times in the head; the maxillary barbel extends to or nearly to the posterior extremity of the head; in the young it is much longer, reaching to the middle of the pectoral; the mandibulary barbel two-thirds as long as the maxillary, the mental barbel less than half as long; the lips minutely rugose and velvety; the teeth in the upper jaw sharp, villiform, in a narrow band widest at the extremities, its greatest width 5.5 times in its length; beginning at the front margin of the palate and covering most of its anterior surface, therefore not far apart, are two large, parallel, somewhat ovate patches of blunt, rounded, coarsely granular, thickly crowded teeth, broadest near the anterior end, their length 1.7 to 1.9 times their breadth and 1.45 to 1.55 times the length of the eye; the under jaw very short, the upper band of teeth exposed when the mouth is closed; the villiform teeth of the lower jaw are in a narrower and much longer band than in the upper jaw, divided at the symphysis by a frenum which is an inward extension of the lip; the dorsal fin equal to or a little less than the depth, shorter than the head without the snout, about two-thirds of the head, its stout spine granulate-serrate before and behind; the pectoral about 1.6 times in the head, its spine a trifle longer than that of the dorsal, flattened, its outer margin feebly, its inner margin strongly serrate; the base of the adipose fin twice in that of the anal and 4.25 times in the distance to the posterior end of the dorsal; the caudal deeply lobate, the upper lobe longest or the lobes nearly equal; the ventrals extend back upon the anal to about the seventh ray, their length very slightly more than that of the pectoral; gill rakers 12 + 6, the longest one 2 in the eye; lateral line very conspicuous, beginning below the basal bone before the dorsal spine.

The color in life blackish to leaden above, passing into whitish below, with a brilliant metallic silver and golden bronze luster, the underside of head and belly cream; the fins all blackish on both sides, all except the dorsal and adipose fin with a narrow, milk white border. In alcohol the dorsal region chocolate brown, much paler below the lateral line, the brown thinning out to cream, with a silvery metallic sheen over all; the underparts nearly white; the dorsal dusky brown, paler distally, the adipose dorsal chocolate like the back, the caudal brownish with a hyaline posterior margin; the pectorals reddish brown above, with a broad clear margin, cream white beneath; the ventrals cream white below and above, with a broad clear posterior margin and a large violet-brown patch on the upper side near the base; the anal largely yellowish brown.

Here described from two specimens, 295 and 244 millimeters long, collected in Pasig River by Mr. Thomas Carey Welch, who has for several years generously supplied me with many kinds of living fresh-water fishes. This species is very abundant in Pasig River during the spring and summer months, but is apparently less abundant or absent during the winter months. A female specimen, 235 millimeters long, contained eggs 11 millimeters in diameter on June 30, 1925; another one, 177 millimeters long, was ready to spawn on July 1, 1924.

The color is often blackish brown above, paling rapidly below the lateral line, with a bluish silvery luster over all except the underside; below the lateral line the fish may be silvery white in alcohol, the underside white or cream colored; sometimes the outer part of the adipose fin is pale, nearly colorless.

Abundant in Laguna de Bay, where large quantities are caught and shipped daily to the towns along its shores and to Manila. In the stomach and gut are found quantities of pond-snail shells. Pond snails are exceedingly abundant in Laguna de Bay and evidently form a considerable part of the food of this fish.

I have examined several hundred specimens, both living and alcoholic, from Pasig River and from Laguna de Bay, especially at Santa Cruz, Laguna Province, ranging in length down to 72 millimeters. In the young the teeth are apparently in a small patch at the outer part of each side at first; then a second patch starts about the middle of the palate, the two eventually coalescing to form a single mass.

I also have six specimens, 105 to 147 millimeters in length, from Manila Bay, at Orani, Bataan Province, and six specimens, of about the same size, from Cavite.

This species, known only from a single specimen, about 355 millimeters long, collected by Eydoux and Souleyet in Manila, was placed under the genus *Rita* by Günther, presumably because Valenciennes described it in a section of his genus *Arius* made up of Indian species now called *Rita* belonging to the family Bagridæ, in which the posterior nostril has a barbel. There is nothing in Valenciennes's description to suggest *Rita* and, needless to say, Eydoux and Souleyet never collected a *Rita* in Manila.

I place here the fish described by Sauvage, collected in Luzon by L. Laglaize. The only marked differences are anal 16, head 4 times in the length, and the patches of teeth far apart on the palate. As Sauvage's specimen was but 130 millimeters long, the masses of palatal teeth had probably not gained their full development. He does not say whether he included the caudal fin in the length or not; the anterior anal spines are very small and difficult to make out and they were probably overlooked. I have many specimens with teeth as described by Sauvage, but numerous other specimens link them with what I regard as typical *Arius manillensis.*

I have no doubt that the specimens collected at Santa Cruz from Laguna de Bay by Dr. A. B. Meyer in 1872, and listed by him as *A. falcarius,* and the specimens listed under the same name by the Spanish writers are really *A. manillensis.*

Arius dispar sp. nov. Plate 1, fig. 6.

Anal 18; pectoral 1–11.

Body elongate, the posterior half much compressed laterally, the depth 5.34 times in the length; the head 3.22 times in the length, its breadth two-thirds of its length and 1.5 times its depth; the dorsal profile gently convex, the snout broadly rounded; the plates on top of the head granulose, with a broad median fontanelle beginning opposite the posterior nostril and narrowing some distance beyond the eyes to a slit which continues almost to the occipital process; the latter bluntly triangulate, the sides slightly bowed, densely granulate, its blunt posterior margin in contact with the narrow, crescentic, granulose bone at the base of the dorsal spine; the humeral process small, sharply triangulate, smooth; the snout projects beyond the lower lip but the upper teeth are not exposed; the eye rather high up, 7.3 times in the head, 2.65 times in the snout, and 3.2 times in the interorbital; the sharp villiform teeth of the upper jaw are in a slightly curved band, widest at the ends, its breadth 5 times in its length; the slightly longer and much narrower crescentic band of similar teeth in the lower jaw is divided at the middle by a narrow toothless space, broadest centrally and very narrow at the ends; on the palatine bones are two small, very widely separated, ovate-triangulate patches of strong coarse conical teeth, their pointed ends converging forward, the long axis 2.5 times in the eye, the width of their base three-fourths of the length; the rest of the palate is perfectly smooth; the maxillary barbel extends to the base of the pectoral; the mandibulary barbel extends to the gill opening and is 1.27 times in the length of the mandibulary barbel; the mental barbel is much shorter, about 1.75 times in the length of the mandibulary barbel; the dorsal fin 1.3 times in the head, its spine 1.73 times in the head, its anterior margin granulose, becoming serrate near the tip, and serrate behind; the pectoral is 1.4 times in the head, its flattened spine smooth on its basal half, serrate on the upper half on both margins, $1\frac{2}{3}$ times in the head, slightly longer than the dorsal spine; the ventrals extend to the fifth or sixth anal ray, their length $1\frac{2}{3}$ times in that of the head; the caudal is deeply notched, the upper lobe longest, 3 times the length of the middle rays; the base of the adipose fin is 1.76 times in that of the anal, 3.7 times in the distance to the dorsal; gill rakers stiff, laterally somewhat flattened, 12 + 7, all elongate, the longest one twice in an eye diameter; the lateral line conspicuous, its origin beneath that of the dorsal; an axillary pore present.

The color in alcohol blackish brown above with a metallic sheen on the sides, passing into bright silvery below the lateral line, the lower and under part of the trunk and underside of the head white; the dorsal blackish, the lower half of the adipose dorsal deep red-brown by transmitted light, blackish brown when viewed directly; the upper side of the pectoral dusky, its underside and both sides of the ventrals white; the caudal pale brown, clear posteriorly.

Here described from a specimen, 235 millimeters long, from Paco market, Manila. I also have a specimen, 232 millimeters long, from Laguna de Bay and one, 225 millimeters long, from Pasig River; in these the base of the adipose fin is almost 4 times in the distance to the dorsal. Another specimen, 200 millimeters long, from the Quiapo market, Manila, has twenty anal rays and cylindrical gill rakers, but is otherwise sufficiently like the type to be placed here. Professor E. C. Starks, of Stanford University, obtained a very fine specimen, 340 millimeters long, at Los Baños, Laguna Province. Its elongate snout and thick lips make this species noticeable when seen among the common catfishes of Laguna de Bay.

I can find no similar fish described in the literature, the teeth and gill rakers separating it at once from anything described by Bleeker, Günther, Day, Vaillant, Sauvage, or Weber and Beaufort.

This fish is very abundant in the esteros in the City of Manila. In November, 1925, thousands were killed by the excessive multiplication of some flagellate protozoan in the water of esteros, and the consequent coating of the fishes' gills.

Arius thalassinus (Rüppell). Plate 1, fig. 7.

Bagrus thalassinus RÜPPELL, Neue Wirbelt., Fische (1835) 75.
Arius nasutus (CUVIER and VALENCIENNES), Hist. Nat. Poiss. 15 (1840) 45.
Netuma thalassina BLEEKER, Atlas Ichth. 2 (1862) 28, pl. 61.
Arius thalassinus GÜNTHER, Cat. Fishes 5 (1864) 139; DAY, Fishes of India (1878) 463, pl. 104, fig. 4, and pl. 106, fig. 1; WEBER and BEAUFORT, Fishes Indo-Austr. Arch. 2 (1913) 287, figs. 106 and 114.

Anal 15 to 18; pectoral 1–11 to 13.

The robust, elongate body varies considerably in height, the young being deeper, the depth 4.5 to 5 times in the length, only the caudal peduncle much compressed laterally; the head 3.2 to 3.6 times in the length, its breadth 1.3 to 1.5 times in its length and 1.66 to 1.8 times its depth; in large specimens the dorsal profile is a little convex from the base of the dorsal to a little behind the eyes, then a trifle concave, convex again from the nostrils to the tip; in others the profile is more or less slightly convex to nearly straight; the plates on top of the head are more or less granulose, thickly so in large specimens, with a median fontanelle beginning near the tip of the snout, broadening rapidly, widest above the eyes, then narrowing rapidly to a long slit which extends to or nearly to the occipital process; this is more or less triangular, with straight to convex sides, elevated and with a median keel which is less evident to rounded in large specimens, densely covered with rather small granules, much longer than broad, its posterior margin truncate to convex but never notched, touching the rather narrow, curved or crescent-shaped, coarsely rugose bone at the base of the dorsal spine; the humeral process large, triangular, its surface covered with raised wavy lines; the broad snout bluntly rounded to pointed in old specimens, projecting beyond the lower jaw, the upper band of teeth exposed, 2.45 to 2.6 times in the head; a prominent, laterally projecting bone before each eye; the eye is somewhat obliquely placed, with a free margin, the broadly ovate pupil vertical, 2.1 to 2.5 times in the snout, 5.7 to 6.3 times in the head and 3 to 3.2 times in the interorbital; the maxillary barbel reaches to the base of the pectoral in smaller specimens, but in large ones not much beyond the rear margin of the preopercle; the mandibulary barbel is a little more than half as long, the mental barbel about a third of the maxillary barbel; the sharp villiform teeth of the upper jaw are in a curved band, its length 6 to 6.5 times its breadth; the similar teeth of the lower jaw are in a longer, narrower, semilunar band, divided at the middle by a conspicuous septum, broadest centrally, very narrow at the ends; at the front margin of the palate are four united patches of villiform teeth forming a curved crossband; behind this on each side is a large, roughly triangulate patch of villiform teeth which usually touches the basal patches but may be more or less separated by a toothless strip; the dorsal fin 3.6 to 3.9 times in the length, a little shorter than the head, the sharp spine granulose in front, the upper part serrated behind, 1.2 to 1.3 times in the head; the pectoral 1.4 to 1.6 times in the length, its flattened spine coarsely granulose in front, serrated behind, a little shorter than the dorsal spine; the ventrals do not reach the anal in our specimens, and are much less than the dorsal, 1.8 to 1.9 in the dorsal, 2 to 2.2 times in the head; Weber and Beaufort say "ventrals reaching on anal, their length equal to height of dorsal," but I do not find them so in Philippine material at hand; the base of the adipose fin 3.1 to 3.5 times in the base of the anal, 9.66 to 10 times in the distance to the dorsal; the caudal deeply notched, the lobes pointed, the upper one longest and 3.3 times the middle rays; gill rakers 9 + 5, stiff, subcylindrical, the longest less than half an eye diameter.

Color reddish to bluish brown, darkest above, paling low down on the sides, with a silvery luster, the underside whitish; the fins are more or less dusky, the underside of the pectorals and ventrals more or less white; the caudal paler than the other fins; the upper half of the adipose fin black.

Here described from several specimens, 260 to 350 millimeters in length, from Manila Bay and from Bulan, Sorsogon Province. This is the most abundant and most important Philippine catfish; it is caught in large quantities in fish traps in shallow bays and estuaries and in Laguna de Bay. Specimens from half to three-fourths of a meter in length are common in the Manila markets.

I place here a specimen, 270 millimeters long, from Manila Bay, which has but two patches of teeth on each side of the palate; it is probable that the two anterior transverse patches on each side have become completely united, leaving no trace of any dividing line or point of junction; in other respects it does not differ markedly from ordinary *A. thalassinus;* the underside is white, with several large patches of minute violet-brown specks; base of adipose fin 9 times in distance to dorsal. Study of a large series shows that the patches of palatal teeth may fuse so that there are but two patches on each side, each roughly triangular, the two basal patches fused with the posterior one, but all showing more or less distinctly their original separation.

The Bureau of Science collection also contains two specimens, each about 165 millimeters long, from Culion.

This is a widely distributed species, ranging from the Red Sea and Zanzibar to North Australia and the coast of Cochin China.

Genus **HEMIPIMELODUS** Bleeker

Hemipimelodus BLEEKER, Ichth. Arch. Ind. Prodr. I Siluri (1858) 236.

Body elongate, laterally compressed posteriorly, the head more or less depressed; the transverse mouth moderate to small, with prominent or projecting snout; the jaws each with a band of villiform teeth, the palate toothless; the head plates are more or less granulate to rugose, exposed or covered with skin, the occipital process keeled or winged, granulate or roughened, posteriorly touching the basal bone of the dorsal spine; the maxillary, mandibulary, and chin barbels long and slender; the nostrils close together, without a barbel; the eyes may or may not have a free margin; the dorsal has a pointed spine and seven rays, its origin halfway between the ventrals and pectorals or nearer the latter; the pectorals also have a sharp spine; the ventrals have six rays, the anal fifteen to twenty; the adipose fin is moderate or short, its origin above or slightly before the anal; the caudal deeply forked; an axillary pore is present; the gill membranes united, attached to the isthmus along the median line, leaving a narrow margin free; gill rakers in moderate number; branchiostegals five or six.

A small genus of East Indian catfishes, apparently confined to fresh water, with one species in the Philippines.

Hemipimelodus manillensis (Cuvier and Valenciennes).

Pimelodus manillensis CUVIER and VALENCIENNES, Hist. Nat. Poiss. 15 (1840) 142.

Hemipimelodus manillensis JORDAN and RICHARDSON, Check List Phil. Fishes (1910) 13.

Anal 18 to 20; pectoral 1–10.

Body elongate, slender, the posterior third compressed, the caudal peduncle strongly so, the depth 5.1 to 5.9 times in the length; the dorsal profile of the head slightly convex, the head much depressed before the eyes, 3 to 3⅓ times in the length, its breadth about 1.5 times in its length and 1.5 to 1.6 times its depth; the head finely granulate above, the occipital process keeled, thickly covered with small granules, much longer than broad, the sides sinuous, notched at the apex, the basal bone of the dorsal spine short, curved, narrow, granulose; the median fontanelle is very long, beginning on the snout between the nostrils, broadening to beyond the eyes, then narrowing rapidly to a slit which extends nearly to the occipital process; the projecting snout broadly rounded, 2.8 times in the head; eyes lateral, placed obliquely, with free orbital margin, 6.4 to 7.2 in the head, 2.3 to 2.5 times in the snout, and about 3 times in the interorbital; the maxillary barbel reaches or nearly reaches the posterior margin of the head, the mandibulary about 0.7 as long, reaching the gill opening or beyond, the mental much shorter, scarcely 0.4 of the maxillary barbel; the mouth rather small, 2.8 times in the length of the head, the lower jaw shorter than the upper but the upper band of teeth not exposed; the villiform teeth of the upper jaw are in a narrow curved band, broadest at the ends, the length about 6 times its width; the teeth of the lower jaw are in a narrower and longer band, divided into two parts by a median septum, widest at the middle and tapering to a point at the outer ends; the dorsal 1.3 to 1.4 times in the head; the front margin of the flattened dorsal spine granulose below, becoming serrate near the tip, its posterior margin serrate on the upper two-thirds, the remainder smooth, its length 1.75 to 1.9 times in the head; the pectoral equals or nearly equals the head without the snout, 1.55 to 1.62 times in the head, its spine like that of the dorsal and equal to it in length; the base of the adipose fin is 1.8 to 2 times in that of the dorsal, 2.2 to 2.7 times in that of the anal, and 4.5 times in the distance to the dorsal; the ventrals reach or nearly reach the anal; the caudal deeply lobed, the lobes acutely pointed, the upper one the longer, 3.3 to 3.6 times the median rays; an axillary pore present; gill rakers long, slender, laterally flattened, 12 + 6, two-thirds or a trifle more of an eye diameter in length.

The color in alcohol varies from blackish to chocolate brown above to bluish brown or light brown on the sides, with a silver luster, becoming yellowish white beneath; the dorsal blackish, the adipose fin with a blackish or chocolate brown spot; the caudal brown, with a clear posterior margin; the upper surface of the pectoral blackish brown, its underside pale; the ventrals and anal more or less brownish.

Here described from two specimens, 212 and 220 millimeters in length, from Laguna de Bay. I also have two fine specimens, 230 and 260 millimeters in length, obtained by me from the Manila market.

Eydoux and Souleyet collected at Manila a fish, 140 millimeters long, which was very imperfectly described by Valenciennes. There is no doubt that my specimens represent the same species.

ILLUSTRATION

PLATE 1

[All figures, except fig. 2, drawn by Marcelino Nievera.]

FIG. 1. *Arius magatensis* sp. nov.; teeth of upper jaw and palate, × 1⅓.
2. *Arius crossocheilus* Bleeker; teeth of upper jaw, × ⅔. (After Weber and Beaufort.)
3. *Arius leiotetocephalus* Bleeker, × 1⅓.
4. *Arius goniaspis* Bleeker, × ⅔.
5. *Arius manillensis* Cuvier and Valenciennes. Stages of development of palatal teeth, × 1⅓; *a*, mature; *b*, *c*, *d*, stages of development.
6. *Arius dispar* sp. nov.; teeth of the upper jaw, × 1⅓.
7. *Arius thalassinus* (Rüppell); teeth, showing variations; × ⅔.

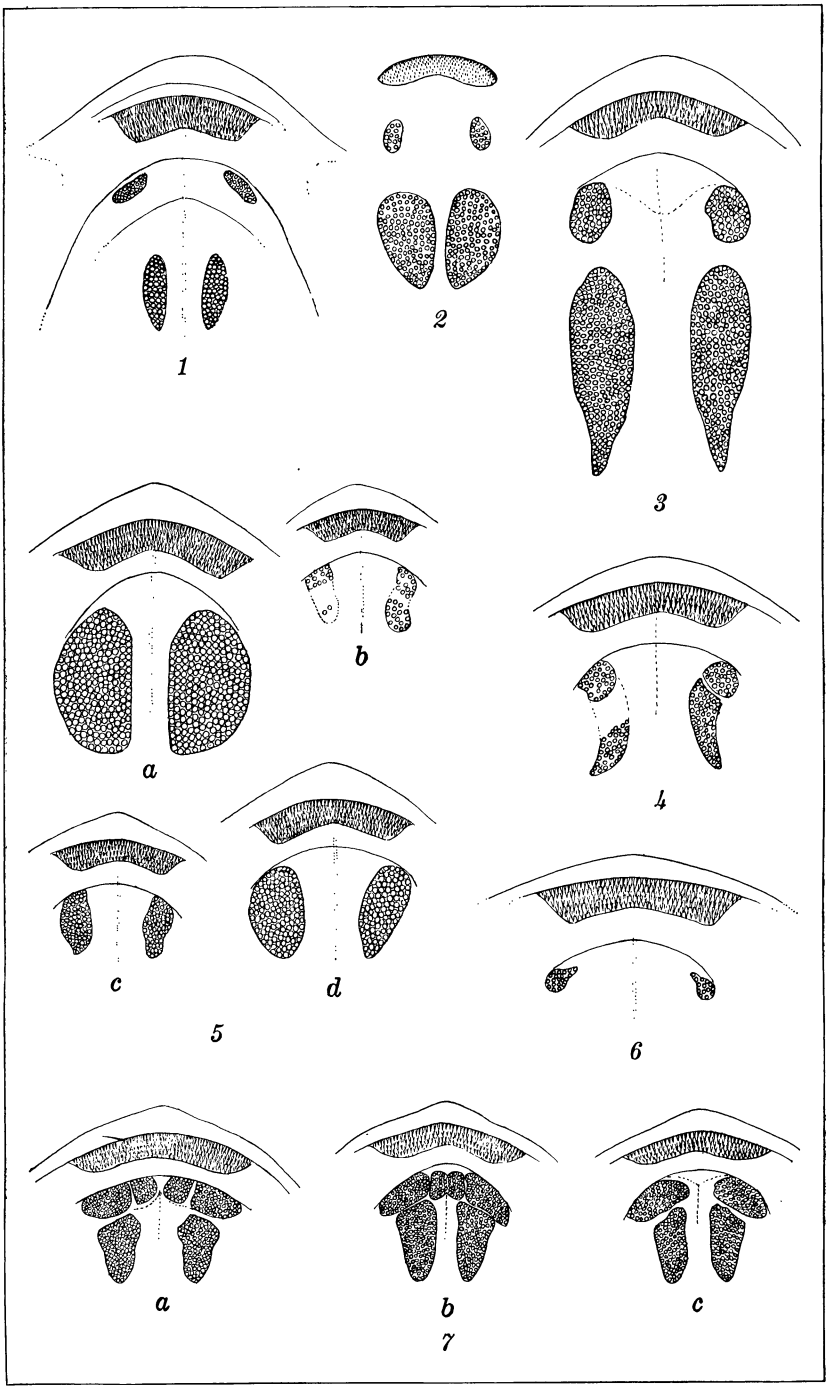

PLATE 1.

HISTOLOGICAL STUDY OF THE BARK OF ALSTONIA SCHOLARIS R. BROWN FROM THE PHILIPPINES

By JOSÉ K. SANTOS

Of the Department of Botany, University of the Philippines, and the Bureau of Science

SIX PLATES

Dita is the name given by the Filipinos to the plant known botanically as *Alstonia scholaris* R. Brown (*Echites scholaris* Linné), an elegant forest tree, 15 to 25 meters high, belonging to the natural order Apocynaceæ. It is widely distributed and very abundant in the Philippines. It is found also from the sub-Himalayan region to Ceylon and Burma, in Java, Timor, and eastern Australia, and in tropical Africa.

A decoction, or infusion, of dita bark has long been used by the people of the Philippines as a remedy for various febrile ailments and for chronic diarrhœa and dysentery. In India also it is used for the treatment of the symptoms mentioned and, besides, as a tonic, an anthelmintic, and an antiperiodic. The drug was classified in the Pharmacopœia of India as one of the standard drugs. An account of the history, uses, and chemical constituents of dita bark is given by Dymock(4) and by Flückiger and Hambury.(5) Among the prominent workers cited by them is Gruppe(8) who was the first to isolate (in 1874) an uncrystallizable, highly hygroscopic, bitter substance which he said possessed febrifugal properties and which he presumed to be alkaloid and named ditaïn. Gorup-Besanez(6) extracted from ditaïn in 1875 a crystallizable substance but, because of lack of material, he was unable to complete the work.

Jobst and Hesse(9) conducted in 1875 a series of very thorough and interesting experiments upon the chemical constituents of dita bark. They isolated and described six definite compounds; namely, ditamin, echicaoutchin, echicerin, echitin, echitein, and echiretin.

In 1906, Bacon(1) published the results of interesting chemical, biochemical, and physiological experiments on the active principles of dita bark. He was able to isolate a fairly good amount of ditamine and echitamine (or echitamonium hydroxide, as it is called by Jobst and Hesse). He found the physiological behavior of dita to be not at all like that of quinine.

While the physiological actions and uses and the active principles of dita have received considerable attention, yet I have failed to find a detailed pharmacognostical study of the macroscopical and microscopical characteristics of the bark upon which the identification of the drug can be based.

Materials and method.—Fresh and commercial dried barks were used in the present study. The fresh material was collected by Maximo Ramos, collector of the Bureau of Science, from a large tree in Antipolo, Rizal Province, and the dried bark was bought in Binondo, Manila, of a retail dealer in some of the Philippine medicinal plants.

The bark of *Alstonia scholaris* is very difficult material to section, especially when it is dried. This is due largely to the presence of an immense quantity of large stone cells, which in groups appear to the naked eye as yellow granules embedded in delicate, thin-walled, parenchymatous tissue, and partly to large quantities of calcium oxalate crystals. The presence of the remarkable, large stone cells and the abundant calcium oxalate crystals make the bark hard, brittle, and granular in texture.

Free-hand sections from fresh material were used, and these were prepared by means of a sliding microtome. Transverse, radial, and tangential sections, about 35 to 60 μ thick, were cut from the fresh bark. Some of the sections were stained with safranin and contrasted with Delafield's hæmatoxylin, and examined under the microscope in a temporary mount in dilute glycerine. The other sections were studied carefully, unstained, in chloral hydrate solution, and these proved to be more satisfactory than the stained ones. This was owing to the opacity of thick stained sections. However, the stained sections brought out certain details not observed in the unstained ones. The characteristics of the individual cells were studied in material macerated by Schulze's method as described by Greenish.(7)

The laticiferous vessels were isolated and carefully examined by means of the potash-maceration process employed by Greenish,(7) using a 2 per cent solution of potassium hydroxide. The latex tubes were treated with a dilute solution of iodine in potassium iodide before examination under the microscope. This solution imparts a yellow color to the laticiferous vessels and makes them more conspicuous than the surrounding tissues.

Description of fresh dita bark.—The bark from the trunk when fresh is 8 to 10 millimeters thick, and externally is grayish to brownish or sometimes purplish brown to green sepia, especially in places where it is covered by pleurococcus. The outer surface is uneven, rough, with many rounded or transversally elongated whitish brown lenticels, sometimes covered with corky pustules, lichens, and longitudinally and transversally cracked or fissured (Plate 1, fig. 5). The outer layer of the cork is easily separable. The inner bark is granular, due to the groups of stone cells, which are yellow and are easily removed from the soft parenchymatous tissue in which they are embedded. It is readily fractured by bending and, when bent or cut, it exudes an abundant, milky white latex which has an intensely bitter taste. The inner surface is creamy white, smooth, light, and soft. When exposed to sunlight it gradually becomes dark or brownish. Figure 5 of Plate 1 represents two pieces of fresh bark taken from different parts of a large trunk of *Alstonia* in Antipolo. When dried under shade it shrinks by about one-third of its thickness.

Commercial dita bark.—The drug is obtained in the market as a mixture of cut and broken irregular pieces, from 6 to 15 centimeters long, 5 to 8 centimeters wide, and 3 to 7 millimeters thick. The bark obtained from the branches, as indicated in Plate 2, fig. 7, usually is thinner and is curved, whereas that from the trunk is thicker and is generally flat or slightly curved, as represented in Plate 2, fig. 6. The outer surface, like that of the fresh bark, is very rough and uneven with numerous rounded or transversally elongated, gray to whitish brown lenticels, and sometimes with a few patches of lichens. The color varies from dark gray to brownish, sometimes with black spots. The external layer is much fissured longitudinally as well as transversally, particularly when the bark is derived from the old trunk and, because of these fissures, the outer layer appears scaly. This outer layer readily separates when handled, in bark prepared from the trunk, but not in bark obtained from the branches. The fracture is short, brittle, and uneven. The fracture surface is granular and spongy in texture. The bark is readily pulverizable. The inner surface is of a sepia color, fibrous in structure, and somewhat striate and indentate. The indentation is due to shrinkage of the bark other than that in the medullary rays, in which the shrinkage is small. The rays, therefore, produce slight elevations over the inner surface. The bark has little or no odor, but is persistently bitter.

Microscopical structure.—In *Alstonia scholaris* it was observed that the formation of the periderm is due to the activity of the subepidermal cells which become meristematic and form the initial phellogen layer (Plate 3, figs. 11 and 12). The first indication of the process is the slight radial elongation of these cells. The daughter cells resulting from the first tangential division differentiate into cork cells toward the epidermis, and those toward the inner side remain meristematic, as shown in Plate 3, fig. 12. In the second tangential division the cells formed toward the epidermis give rise to a phellogen layer, and those toward the inner side into phelloderm, as shown in Plate 3, figs. 13 and 14. By repeated division of the phellogen cells, radial rows of cells toward the exterior and interior parts of the bark are formed. The cells formed toward the exterior are more numerous than are those toward the interior, and they lose their protoplasm and become slightly suberized, thus forming the cork region. Those on the inner side of the phellogen, which form the phelloderm, retain their protoplasm and sometimes have chloroplastids (Plate 3, fig. 15). The phellogen layer, after a certain period of activity, ceases to divide and is replaced by secondary phellogenetic cells formed in the underlying tissue.

For convenience, the cross section of the old bark of *Alstonia scholaris* may be divided into, say, three distinct regions (the term bark is used to include everything outside the cambium). These regions are the peridermal region, the stone-cell region including a portion of the young bast, and the young-bast region. These three regions are shown in Plate 3, fig. 16, which represents a diagrammatic cross section of the bark drawn under an objective 48 millimeters and ocular × 2.

The periderm in *Alstonia* is thin and usually about one-tenth of the thickness of the entire bark. The outer part consists of ten to twenty layers of thin-walled, slightly suberized, sometimes radially elongated and radially arranged cork cells. Interior to the phellogen is the phelloderm consisting of a few layers of cells which are somewhat tangentially elongated and radially arranged. Intermingled with the cork cells are short, sclerenchymatous cells, either isolated or in groups. They appear more or less cubical, and sometimes radially or longitudinally elongated, and have thick and pitted walls. Microchemical test proved that they are lignified. According to De Bary,(3) cells of these types are genetically equivalent to the cork cells and assume the properties of short, sclerenchymatous elements and resemble in all important points the so-called stone cells. They measure from 0.036 to 0.05 millimeter in width, 0.022 to 0.036 millimeter in thickness, and 0.036 to 0.054 millimeter in length. Sometimes they are rounded in cross section. Plate 3, fig. 17, is a detailed representation of the secondary peridermal region.

The stone-cell region occupies more than two-thirds of the thickness of the bark. It comprises the area from the phelloderm region to the young-bast region where stone cells are wanting. It is built up largely of parenchymatous cells with very thin walls, somewhat tangentially elongated or sometimes polygonal or rounded in outline. Some of them contain prismatic and rhomboid crystals of calcium oxalate. Throughout this region enormous, hard, thick-walled, sclerenchymatous stone cells are scattered in great numbers. They form large, irregular groups of a bright yellow color, and are visible to the naked eye. The outline of the individual cells in the cross and longitudinal sections is very irregular; sometimes they are pointed and their cavities are greatly reduced. Their walls are stratified, very much thickened, lignified to stony hardiness, perforated by numerous, usually branched, pit canals of circular appearance in transverse section. Toward the outer part of this region, the stone cells have thinner walls and larger cavities, and are more or less regular in outline than are those of the middle part. They are somewhat radially elongated and radially arranged, as represented in Plate 3, fig. 18. In the middle part of the stone-cell region, the stone cells have a very irregular outline and smaller cavities, sometimes pointed. They measure from 0.045 to 0.3 millimeter in diameter, and from 0.075 to 0.45 millimeter in length. Between the groups of sclerenchyma, or stone, cells there are some pith rays which are characterized by their wavy appearance, as indicated in Plate 3, figs. 19 and 20. Occasionally, between the pith rays and mixed with the phloëm of the stone-cell region, there are a few laticiferous vessels, which contain brownish, granular, latex substances. A detailed study of these vessels is given below.

In the inner part of the stone-cell region, the stone cells are very much reduced in size and are mixed with some bast fibers which measure from 0.06 to 0.15 millimeter in diameter and from 0.45 to 1 millimeter in length, with phloëm cells and phloëm parenchyma. The laticiferous vessels become more numerous, as indicated in Plate 3, figs. 19 and 20.

The third region is the bast proper, which occupies about one-fourth of the entire thickness of the cross section of the bark. It consists mostly of phloëm and phloëm-parenchyma cells, traversed by numerous pith rays and with many latex tubes. Most of the phloëm-parenchyma cells contain abundant prismatic and rhomboid calcium oxalate crystals. In the longitudinal section these crystals are found generally in rows, forming crystal fibers about 0.35 millimeter long. Plate 4, fig. 21, shows a cross section from the innermost part of the bark, and figs. 23 and 24, Plate 4, show radial sections from the inner phloëm and the inner part of the stone-cell region. The medullary or pith-ray cells have thin walls and in some parts are filled with small, ovoid or somewhat rounded starch grains. The starch grains measure from 0.0072 to 0.015 millimeter in diameter and are sometimes found in rows or in groups of three. They are not prominently striated and the hilum is not very distinct. The calcium oxalate crystals are also found rather abundantly among the pith rays. Figures 8 and 10, Plate 2, are microphotographs showing the abundant prismatic or rhomboid calcium oxalate crystals and the position of the latex tubes. Figure 25, Plate 4, is a crystal fiber, measuring about 0.34 millimeter in length and containing prismatic and more or less cubical types of calcium oxalate crystals. The sieve tubes in cross section have a more or less polygonal outline with very thin walls and sieve plates with somewhat rounded pores. These sieve plates appear regular in transverse position or slightly inclined, but in many cases a series of plates is found on the sides of the tubes, as shown in Plate 4, fig. 24. Their diameter is from 0.018 to 0.025 millimeter, and the length of the tube is about 1.8 millimeters. Developed bast fibers are not found in the youngest phloëm.

In the bark of branches that are several years old and in the material bought in the market (shown in Plate 2, fig. 7) characteristic sclerenchyma fibers are found in the pericycle. They are easily distinguished by their white color and their stratification. In the longitudinal section or in the macerated materials these fibers appear constricted at intervals to a small diameter and then abruptly much enlarged, as indicated in Plate 4, figs. 26, 27, and 28, the last-mentioned figure taken from fresh bark of a stem about 1 inch in diameter. According to Solereder,(11) this is a case of local secondary enlargement of the bast fibers accompanied by an encystment of the protoplasm in the widened portion of the fiber by means of the formation of caps of cellulose. The enlarged part, or bulb portion, varies in length from 0.06 to 0.51 millimeter and from 0.05 to 0.15 millimeter in diameter.

Macerated form of the bark.—The material macerated by Schulze's method allows a better view of the individual cells. The varied shapes of the stone cells can be easily distinguished. They appear isolated in most cases, but occasionally they may be found in groups (Plate 6, figs. 39, 40, and 41). They are very irregular in shape and size, from a more or less rounded form to somewhat triangular or rod-shaped, and in some cases they are pointed at one end. The laticiferous vessels are observed in a fragmentary form. The medullary ray and parenchyma cells are found isolated from one another or in groups. The calcium oxalate crystals are very scanty in this sort of preparation. The characteristics of the stone cells found in the dried materials bought in the market agree well with the characteristics of those observed in the fresh material collected at Antipolo, Rizal, as shown in Plate 6, figs. 39, 40, and 41.

The potash maceration is very valuable in the examination of the laticiferous vessels, calcium oxalate crystals, sclerenchymatous tissue, bast fibers, etc. When proper consistency is obtained in this process, the tissues are easily teased out and the latex tubes are rather prominent. Their contents are very well preserved. Under the dissecting microscope they appear as white, somewhat interlacing threads, and under the compound microscope as long tubes placed parallel to each other, with brownish granular content. The walls of the parenchyma cells and the phloëm cells have a tendency to be disintegrated, and generally appear transparent and not well defined under the microscope when the sections are mounted in dilute glycerine or in chloral hydrate solution. Figures 8 and 10, Plate 2, are microphotographs from potash-macerated sections of the young phloëm region in which the latex tubes and the enormous quantity of monoclinic or prismatic calcium oxalate crystals are observed.

To get general information about the structure of the individual cells of the bark, excluding the latex tubes, perhaps the material can be best examined in powdered form. The stone cells or sclerenchymatous tissue, the calcium oxalate crystals, the medullary rays with starch grains in them, and the parenchyma cells are found in somewhat isolated form.

The laticiferous tubes. A full account of the history of the latex is given by De Bary.(3) As a result of the numerous cases carefully investigated, the latex tubes were classified according to their form and development into (*a*) articulated tubes, which arise from a series of elongated cells of the cambium, whose walls coalesce and become perforated or disappear, forming a continuous tube; the laticiferous tubes formed in this way are characterized by their netlike anastomosing structure; and (*b*) nonarticulated laticiferous tubes, which do not exhibit netlike anastomotic characteristics, and all of the branches of which (often very numerous) end blind. According to Solereder(11) laticiferous tubes of this type are generally distributed among the Apocynaceæ and, in the majority of the species that have been investigated, are already present in the embryo. Chauveaud,(2) who made very elaborate studies of the embryonal development of the laticiferous vessels of the Euphorbiaceæ, states that their initial cells arise in the place that coincides with the node of the cotyledons. From this part they appear in the peripheral part of the central cylinder, and are separated from one another by one or a few cells.

Casual statements and quotations by Flückiger and Hambury(5) and by Dymock(4) indicate that the laticiferous tubes in *Alstonia scholaris* are formed from series of ordinary cells by the destruction or disappearance of their cross walls to form continuous tubes. Lanessan,(10) in translating the work of Flückiger and Hambury into French, added in the description that they frequently appear in an anastomosing condition. My findings, however, are quite different. In the examination of the old bark, macerated with 2 per cent of potash, the laticiferous vessels appear as continuous and independent tubes of about 0.045 millimeter in diameter, branching occasionally and running more or less parallel through the inner part of the stone-cell region, and particularly through the inner part of the bark. They exhibit granular contents from 1 to 2 μ in diameter, and have exceedingly thin walls. I was unable to observe a place where the latex tubes anastomose or the slightest indication that they are formed by partial or complete destruction of the cross walls of a series of ordinary cells. The tubes appear uninterruptedly continuous throughout the plant. No trace of articulations was noticed among the many sections examined. Figures 30 and 31, Plate 5, illustrate beautifully the characteristic arrangement and the types of laticiferous tubes in old bark, about 10 centimeters thick, macerated with caustic potash. They are more or less straight and arranged almost parallel to each other, particularly those found in the region of the young phloëm, as indicated in Plate 5, fig. 30, a tangential view of a group of latex tubes obtained from the bast region, in which one of them has a branch. In Plate 5, fig. 31, on the other hand, the tubes are slightly wavy or crooked, due to the fact that they are from the outer part of the young phloëm, where stone cells and ordinary sclerenchyma cells are found.

The relation of the tubes in the longitudinal sections with the other types of tissue where they occur in the bark is indicated in Plate 4, figs. 22, 23, and 24; fig. 22 is taken from the outer part of the young phloëm, showing the relation of a latex tube with the parenchyma, stone, and pith-ray cells; fig. 23, toward the young phloëm where the stone cells gradually disappear; and fig. 24 is from a radial section through the young phloëm and shows very well the parallel arrangement of the tubes and their relation with the phloëm. It is interesting to note, however, that occasionally the latex tubes are found in the pith rays, and this is due to the lateral branching of the vertical tubes.

The parallel arrangement of the latex tubes is more or less indicated in the photomicrographs figs. 8 and 10, Plate 2, although these were taken purposely to show the distribution and abundance of the calcium oxalate crystals. The sections were macerated in caustic potash and stained with iodine solution, so the phloëm and the phloëm parenchyma cells are not clearly seen.

The most significant evidence that the latex tubes in *Alstonia scholaris* are not formed by the destruction of the cross walls of certain series of ordinary cells in the young phloëm was obtained from a critical investigation made on the tips of very young stems. However, I regret having been unable to secure fresh seeds for the study of the embryonal stages of these latex tubes. Nevertheless, with the important facts obtained from the detailed examination of the macerated sections of the tips of the very young stem, it is safe to state here that the tubes are formed by growth and not by fusion of cells. The tubes possess all the morphological characteristics of the nonarticulated tubes. They are more or less dichotomously branched, as indicated in Plate 5, figs. 32, 36, and 37, showing laticiferous vessels dissected carefully from the macerated sections of the tips of young stems. The branching occurs especially in the region of the nodes. The branches may arise at an acute or obtuse angle from the tubes and grow in an upward direction, or at a right angle and grow toward the outer side or toward the lower part of the stem, as shown in the figures (and particularly in fig. 34, which was taken from a macerated section of the bark of a two- to three-year-old branch). The branches make their way through the intercellular spaces in the young phloëm and parenchyma cells. Their diameter is considerably smaller, as compared with that of the surrounding cells (which may indicate that they are not derived from them), and it gradually decreases toward the tip, as represented in Plate 5, figs. 35 and 38. The terminal part of the branch is somewhat wavy or spirally twisted like a screw and with a somewhat pointed tip (Plate 5, fig. 38). Figure 9, Plate 2, is a photomicrograph taken from a macerated section of a stem tip, and shows also the method of branching of the tubes.

In the petiole and midrib of the leaves, the latex tubes occur on the peripheral side of the phloëm region, and sometimes mixed with the phloëm cells. They are arranged parallel and close together as shown in Plate 5, fig. 33, prepared from a macerated section of a portion of the midrib of a nearly mature leaf. Those at the sides of the midrib send out branches which pass through the veins of the leaves. Thus, if the surface of the leaf is injured, a milky fluid is also exuded.

SUMMARY

The chief microscopical diagnostic characteristics of dita bark are the following:

1. The thin-walled, closely fitted, slightly suberized, brownish cork cells.
2. The short, sclerenchymatous cells in the cork region, which have a more or less cubical form.
3. The remarkable stone cells with very much thickened walls, stratified, lignified to stony hardness, perforated by numerous, usually branched, pit canals.
4. The wavy pith-ray cells, containing numerous, small, spherical, often compound starch grains.
5. The calcium oxalate crystals in prismatic, rhomboid, or monoclinic forms, frequently in crystal fibers.
6. The nonarticulated laticiferous tubes, which branch occasionally.
7. The series of sieve plates arranged on the sides of the sieve tubes.

8. In the bark from the branches, the characteristic fibers which are constricted at intervals to a small diameter and then abruptly much enlarged.

ACKNOWLEDGMENTS

I am indebted to Dr. W. H. Brown, director, Bureau of Science, and to Dr. Leon Ma. Guerrero, botanist, Bureau of Science, for suggestions and advice.

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ILLUSTRATIONS

[All drawings by the author. The photographs were prepared by the photographer of the Bureau of Science, except fig. 7, which was prepared by the Department of Botany, University of the Philippines.]

PLATE 1. ALSTONIA SCHOLARIS R. BROWN

FIG. 1. A habit sketch of a small part of a branch, showing type of inflorescence and arrangement of leaves. × ⅔.
2. A single flower. × 2.2.
3. A cluster of mature fruits, showing the twisting and the dehiscing in one side of the follicles. × ⅔. *s*, seeds.
4. A seed enlarged. × 1.6.
5. A photograph of fresh bark collected at Antipolo, Rizal Province, showing the uneven, rough, fissured character of the outer surface, with lenticel, *l*. × ⅔.

PLATE 2. ALSTONIA SCHOLARIS R. BROWN

FIG. 6. Photograph of bark bought in the market; *a*, *b*, dorsal views; *c*, transverse section; *d*, inner view, showing indentation. × ½.
7. Photograph of another sample bought in the market, representing type of bark collected from branches; *a*, outer surface, showing longitudinal fissures and the transversally elongated lenticels, *l*; and *b*, inner surface with indentation. × ½.
8. A microphotograph of a section through the young phloëm prepared from material macerated with caustic potash; *lv*, laticiferous vessels; *co*, calcium oxalate crystals. × 50.
9. A microphotograph of a section through the tip of a very young stem macerated with caustic potash; *lv*, laticiferous vessels, showing method of branching. × 50.
10. Another microphotograph of a section through the young phloëm of younger bark, showing laticiferous vessels, *lv*.

PLATE 3. ALSTONIA SCHOLARIS R. BROWN

FIG. 11. A transverse section of very young bark before the formation of the phellogen layer, showing epidermis and outer part of cortex. × 330.
12. A transverse section through the epidermis and outer part of cortex from a young stem; the subepidermal cells have elongated and divided; the outer layer becomes cork cells and the inner one the phellogen layer, *ph*. × 330.
13. A transverse section through the epidermis and outer part of cortex from a young stem, showing the two layers of cells produced by the division of the phellogen; the outer layer remains as phellogen and the inner one becomes the phelloderm layer. × 330.

FIG. 14. A transverse section of the outer part of the bark, showing the second division of the phellogen producing another layer of cork cells toward the outside; *ph*, phellogen; *pe*, phelloderm.

15. Another transverse section through the outer part of young bark, showing additional cork cells formed by the activity of the phellogen, *ph; pe*, phelloderm. × 330.

16. A diagrammatic sketch of a transverse section of old bark, drawn under the camera lucida with ocular × 2 and objective 48 mm. *k*, periderm; *co*, calcium oxalate crystals; *lv*, laticiferous vessels. × 8.

17. A detailed transverse section of the periderm, indicating *k*, cork; *sc*, stone cells; *pe*, phelloderm cells; *co*, calcium oxalate crystals. × 100.

18. Outer portion of a transverse section of the cortical region; *co*, calcium oxalate crystals; *sc*, stone cells. × 100.

19. A portion of a transverse section from the inner part of the cortical region; *sc*, stone cells; *lv*, laticiferous tubes; *r*, medullary ray with starch grains; *co*, calcium oxalate; *p*, parenchyma. × 100.

20. A small portion of a transverse section of the bast; *r*, medullary rays; *bf*, bast fibers; *lv*, laticiferous vessels; *co*, calcium oxalate; *sg*, starch grains. × 100.

PLATE 4. ALSTONIA SCHOLARIS R. BROWN

FIG. 21. A transverse section of the innermost part of the young phloëm, showing a number of laticiferous vessels, *lv; r*, medullary rays; *co*, calcium oxalate.

22. A longitudinal section through the inner part of the stone-cell region, showing *sc*, stone cells; *r*, medullary rays; *co*, calcium oxalate; *lv*, laticiferous vessels. × 100.

23. A radial section near the young phloëm; *co*, calcium oxalate; *r*, pith rays; *p*, parenchyma cells; *lv*, laticiferous vessels. × 100.

24. A radial section through the young phloëm, showing *st*, sieve tubes; *sp*, a series of sieve plates; *lv*, laticiferous vessel; *co*, calcium oxalate; *r*, pith rays. × 100.

25. A crystal fiber from the young phloëm. × 196.

26. A bast fiber from material bought in the market, as indicated in Plate 2, fig. 7; *c*, cup of cellulose. × 64.

27. A bast fiber from macerated material bought in the market, as indicated in Plate 2, fig. 7; *c*, cup of cellulose. × 64.

28. A bast fiber isolated from the fresh bark of a small branch from Antipolo, Rizal Province. × 64.

29. A group of starch grains from medullary rays of fresh bark. × 385.

PLATE 5. ALSTONIA SCHOLARIS R. BROWN

FIG. 30. A group of laticiferous vessels dissected from the young phloëm of fresh bark macerated with caustic potash; *lb*, branch of laticiferous vessel. × 45.

31. A group of laticiferous vessels dissected from the outer part of the young phloëm between the stone cells, of fresh bark macerated with potash. × 45.

FIG. 32. A laticiferous vessel dissected from the very tip, near the node of a young stem, showing method of branching. × 45.

33. A group of laticiferous vessels drawn from a macerated section of the midrib of a nearly mature leaf. × 45.

34. A branching laticiferous vessel isolated from fresh bark of a two- to three-year-old branch. × 45.

35. A tip of a laticiferous vessel, *lv*, showing its relation with the surrounding parenchyma cells; *co*, calcium oxalate. × 126.

36. A branching laticiferous vessel taken from the youngest node at the tip of a stem. × 55.

37. A branching laticiferous vessel prepared from the node at the tip of a young stem, showing two of the small branches pointing downward. × 55.

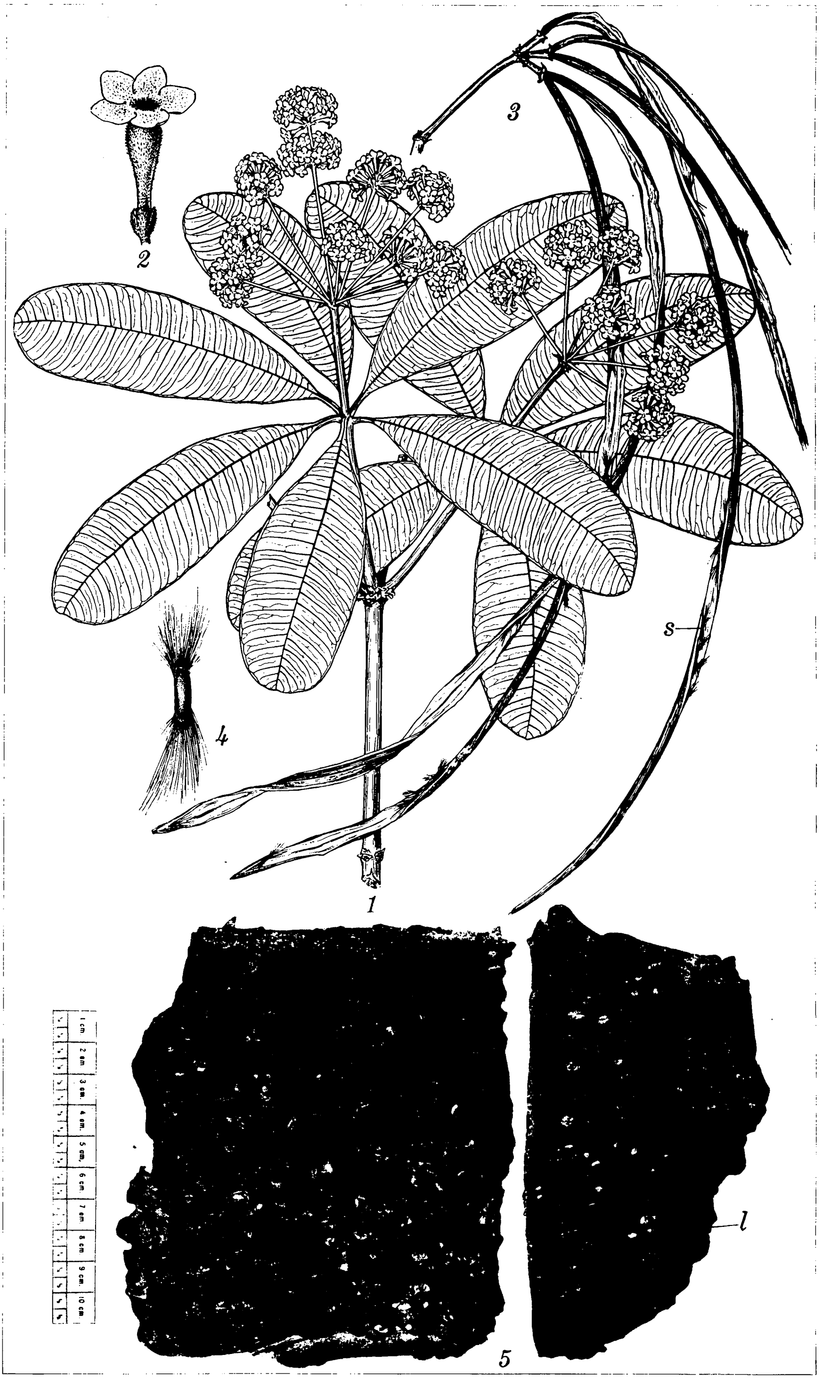
38. A tip of a branch of a laticiferous vessel, *lv*, showing the more or less spiral characteristic, like the tip of a screw. × 126.

PLATE 6. ALSTONIA SCHOLARIS R. BROWN

FIG. 39. A group of stone and sclerenchyma cells isolated from fresh bark by means of Schulze's method. × 67.

40. A group of stone and sclerenchyma cells from material bought in the market, as represented in Plate 2, fig. 6. × 67.

41. A group of stone and sclerenchyma cells from material bought in the market, as represented in Plate 2, fig. 7. × 67.



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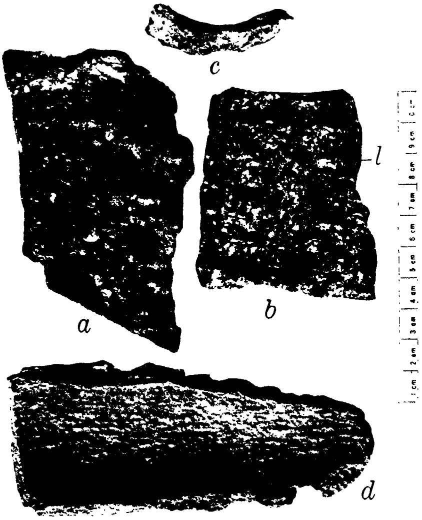

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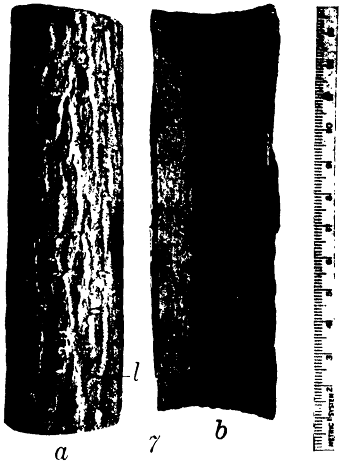

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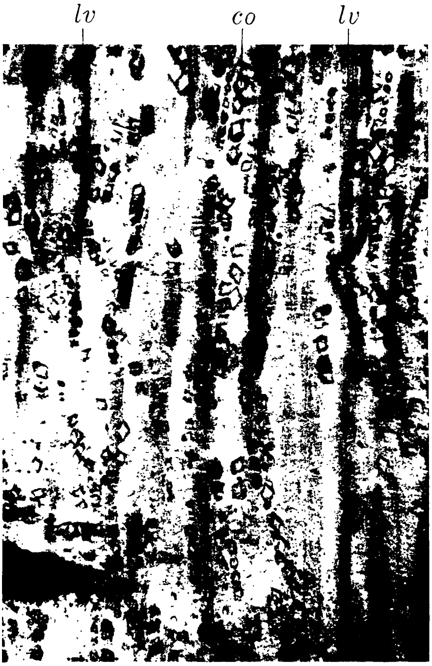

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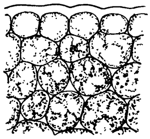

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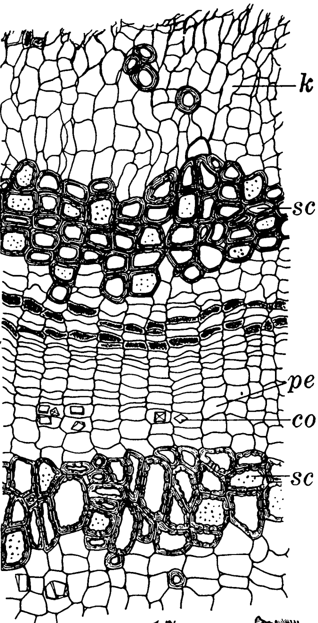

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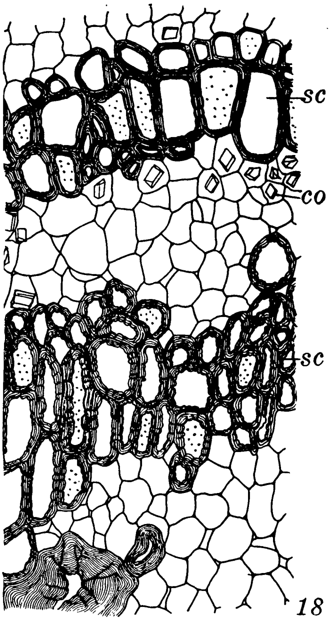

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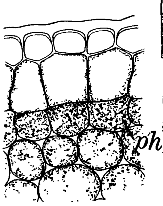

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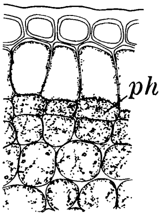

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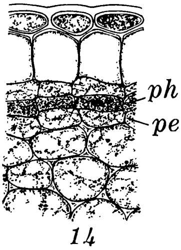

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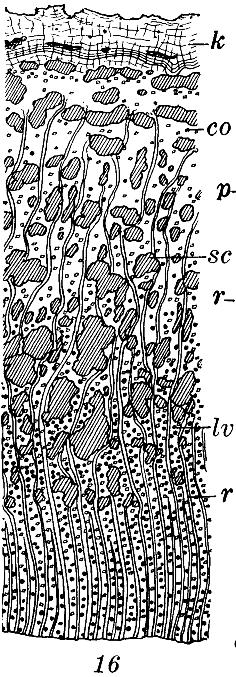

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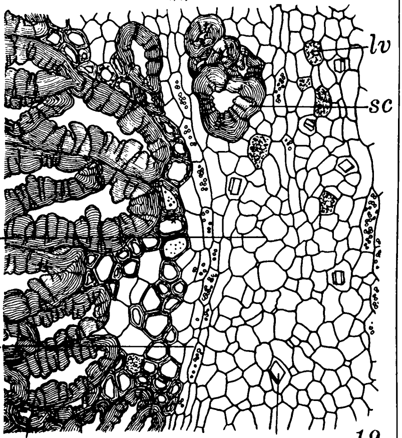

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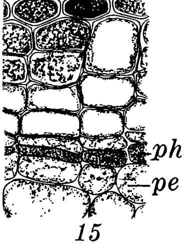

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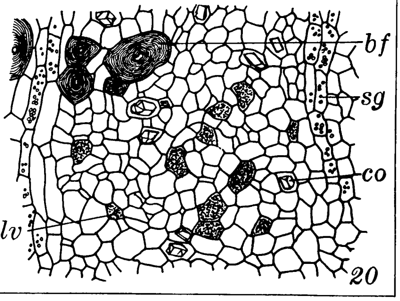

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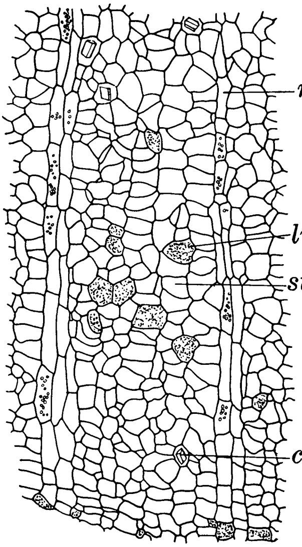

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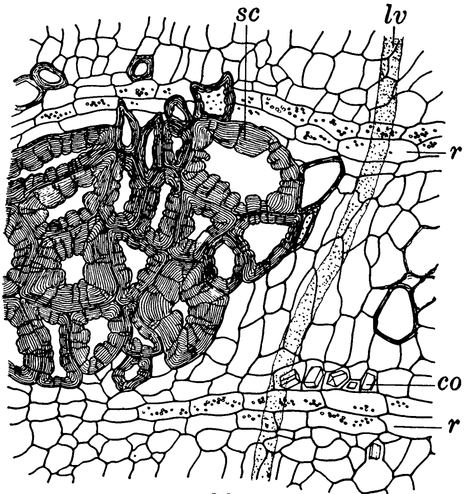

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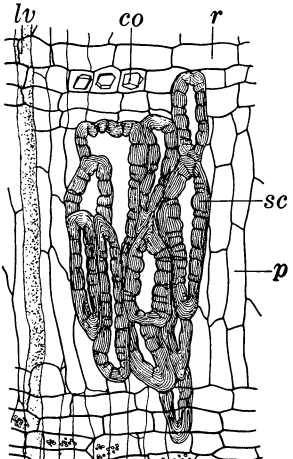

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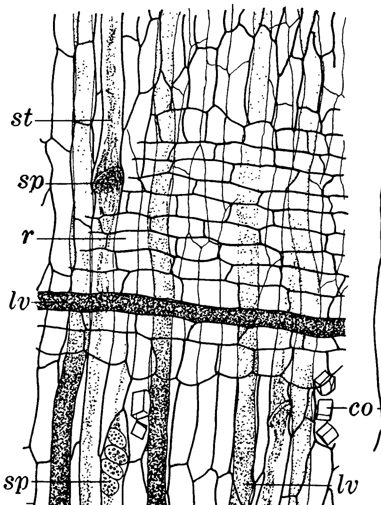

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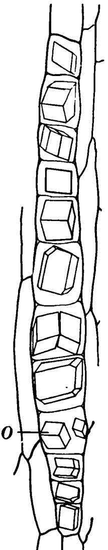

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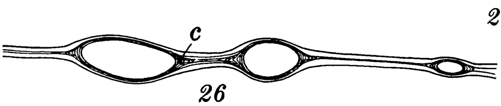

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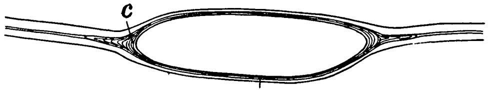

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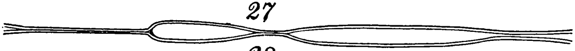

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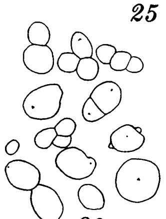

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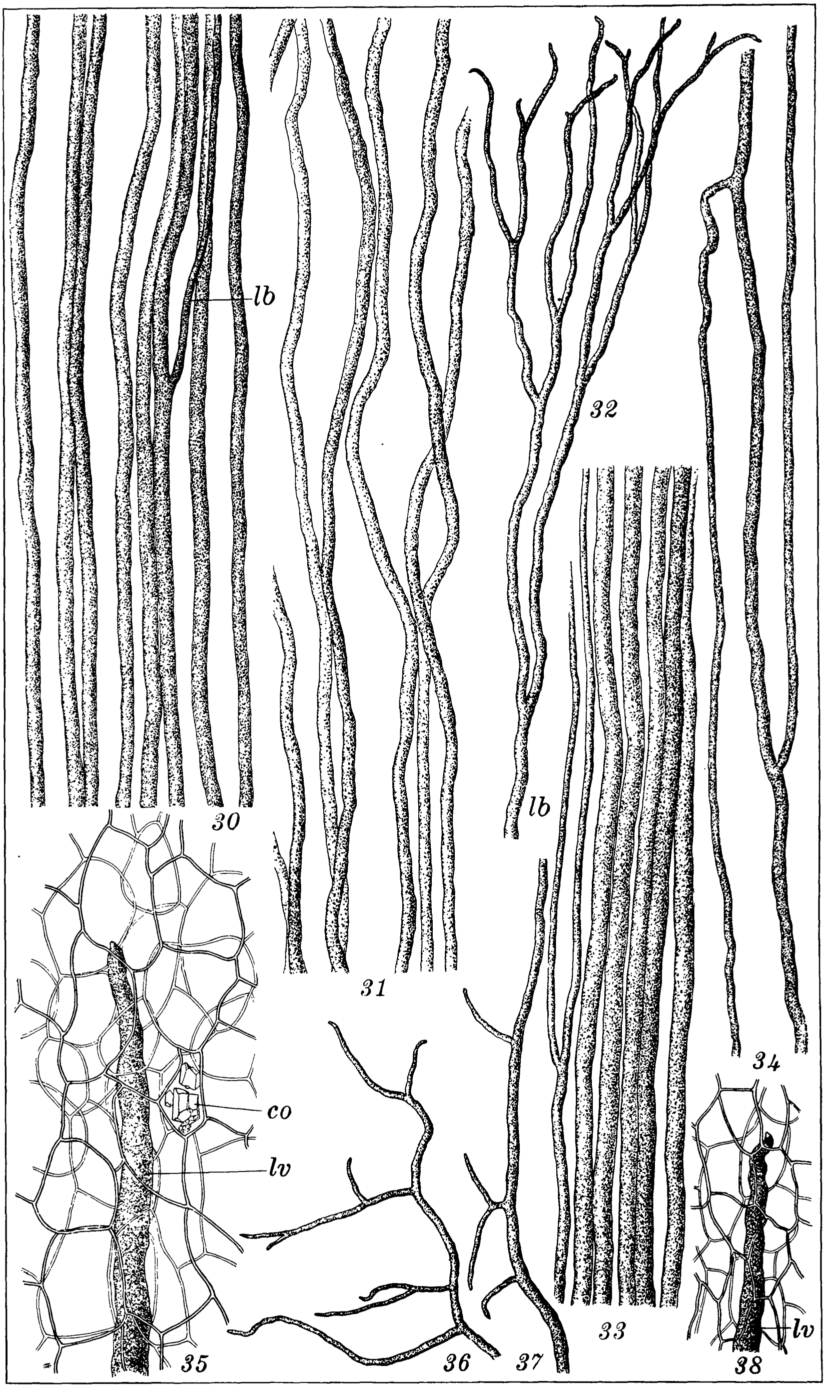

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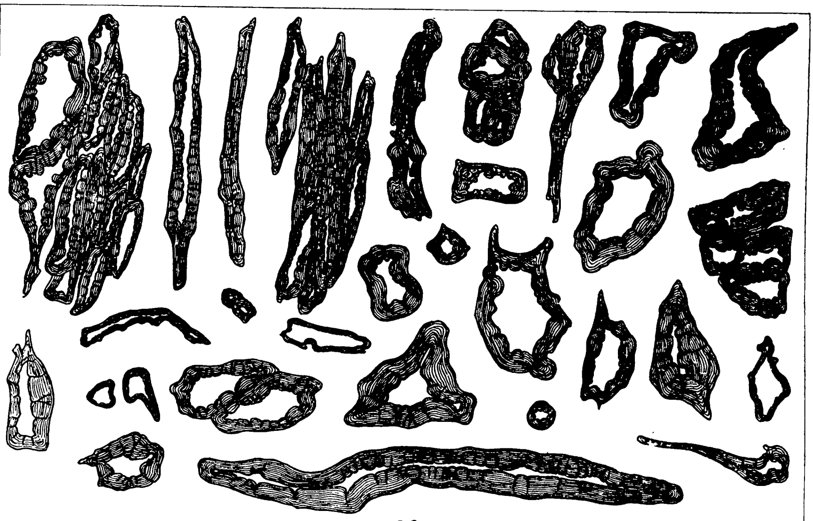

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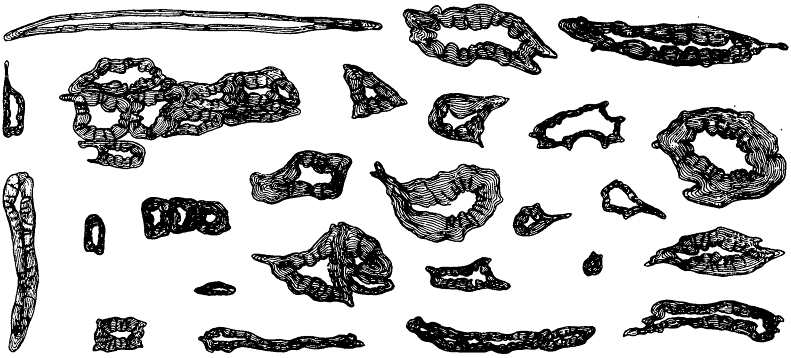

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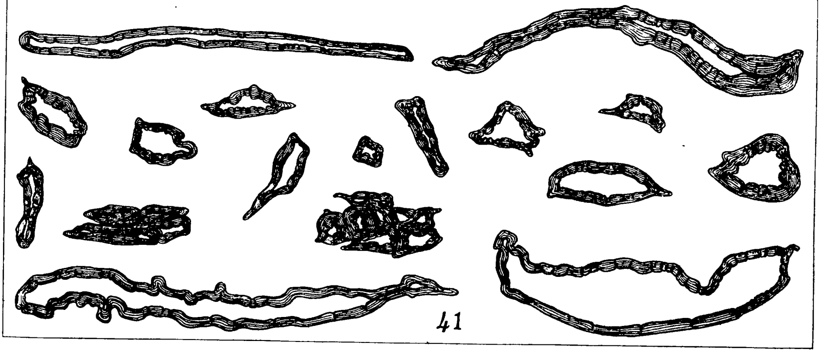

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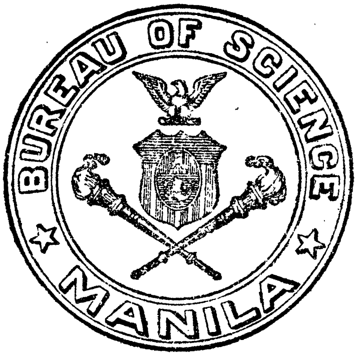

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THE PHILIPPINE JOURNAL OF SCIENCE

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SOME FACTORS INFLUENCING, IN VIVO, THE RESULT OF THE GLOBULIN PRECIPITATION TEST

By K. YASUYAMA[1]

Of the Division of Biology and Serum Laboratory,
Bureau of Science, Manila

In the early history of the globulin precipitation test as inaugurated by Klausner the explanation for the occurrence of a precipitate in a fresh serum upon dilution with distilled water was given by that author. It was claimed that the precipitable substance is a globulin. It was maintained by Klausner[2] that this reaction is different in its nature from the Wassermann reaction, in as much as it occurs in the early stage of syphilis a long time before the Wassermann reaction becomes positive. In 1924 Schöbl and Basaca[3] showed that the globulin precipitation reaction was positive in 100 per cent of lepers examined. Furthermore, Schöbl and Ramirez[4] found that this reaction is positive in yaws, in which disease, as in syphilis, the globulin reaction precedes the Wassermann reaction; and, after thorough specific treatment of cases of yaws, when the Wassermann reaction has become negative, the globulin precipitation reaction persists, particularly in patients who show residual symptoms such as intumescence of lymphatic glands. In that respect the globulin reaction, although not specific, is an anamnestic reaction. During the study of serology of yaws Schöbl and Ramirez [4] proved experimentally that the precipitate which forms from fresh frambœsic serum, upon dilution with distilled water, is not the carrier of the Wassermann antibody. It has been shown that the precipitate is insoluble in water, that it gives a characteristic reaction for protein, and is soluble in any concentration of sodium chloride. From these findings a conclusion was drawn by these authors that the balance between salts and globulins in the positive sera is upset.

---

[1] Lieutenant Surgeon, Imperial Japanese Navy.

[2] Wiener Klin. Wochenschr. 21 (1908) 214, 363, and 940.

[3] Philip. Journ. Sci. 25 (1924) 1.

[4] Philip. Journ. Sci. 30 (1926) 483.

It remained to demonstrate experimentally how far the result of this precipitation test is influenced by the increase or decrease of protein substance in the circulating blood or by the increase or decrease of concentration of salts contained in the circulating blood. Experiments were arranged on rabbits, therefore, in such a way that their sera were subjected to this test before and after the injection of a foreign protein and of hypertonic and hypotonic salt solution. The details of the experiments are given in the tables forming a part of this paper.

DESCRIPTION OF TECHNIC

About 5 cubic centimeters of blood were withdrawn from the heart of the animal to be examined, by means of a sterilized syringe which was thoroughly washed with a sterilized physiologic salt solution to prevent hæmolysis.

The blood was placed in a sterilized test tube which was moistened with sterilized salt solution; it was allowed to stand until the serum separated.

Only absolutely clear sera were used.

Five small test tubes for each blood specimen were arranged in a rack. One Wright's pipette marked to contain 0.2 cubic centimeter, and another one marked to contain 0.6 cubic centimeter, were rinsed with distilled water three times and dried.

Two-tenths cubic centimeter of the fresh serum of the animal was placed in each tube by means of the 0.2 cubic centimeter Wright's pipette.

Distilled water was added to the five tubes from 1 to 5, in increasing amounts, to represent final dilutions of 1: 1, 1: 2, 1: 3, 1: 4, and 1: 5.

Each tube was then revolved around its axis so as to mix the serum and the distilled water thoroughly.

The same dilutions of serum as described above were duplicated, using physiologic salt solution instead of distilled water.

The tubes were allowed to stand at room temperature (about 28° C.) for two hours. They were then placed in the refrigerator; the result was read and recorded the next morning.

DISCUSSION OF EXPERIMENTS

Animal 1 was tested by the globulin precipitation test (see Table 1); in none of the dilutions (1: 1, 1: 2, 1: 3, 1: 4, 1: 5) did precipitation, either with salt solution or with distilled water, take place. The animal then received intravenously 10 cubic centimeters of hypotonic salt solution. Blood was withdrawn from the heart of the animal and the clear serum gave precipitation in dilution with distilled water, but not with physiologic salt solution. The next day the animal received 10 cubic centimeters of normal horse serum per venam. It was bled again and its serum gave positive precipitation reaction in all dilutions, both with distilled water and with salt solution. Six days after the injection of horse serum a precipitate was still noticeable with animal serum in dilutions 1: 2, 1: 3, 1: 4, and 1: 5 with distilled water, but no precipitation occurred upon dilution with salt solution. Two weeks after the injection of horse serum per venam, the serum of the same animal gave a faint precipitate in dilutions 1: 1 and 1: 2, and distinct precipitate in dilutions 1: 3, 1: 4, and 1: 5; a trace of precipitate was noticeable in dilutions 1: 4 and 1: 5 with salt solution. Immediately after the injection of 10 cubic centimeters of 10 per cent salt solution the serum of the animal gave a negative result, as far as the precipitation is concerned, in all dilutions with physiologic salt solution as well as with distilled water.

Experiments on rabbits 2, 3, and 5, as evident from Tables 2, 3, and 4, are practically a duplication of the first experiment, the only difference being that rabbit 5 was injected with horse serum inspissated to one-fourth of the original volume. Although the results with these three rabbits vary somewhat quantitatively, it is evident that the effect upon the result of the test of the increase or decrease of the salt on the one hand, and of the protein on the other hand, was in the same direction. It is further evident that the balance of the salts and protein in the circulating blood, upset by the dilution or high concentration of salts, rectified itself far more quickly than was the case when the concentration of the protein was increased by the injection of protein solution—that is, horse serum. It stands to reason that a small molecular salt solution will be eliminated more quickly than will the large molecular protein.

In the next experiment (see Tables 5 and 8) the influence of feeding and starvation upon the result of the globulin precipitation test was studied. The animals were starved twenty-four or forty-eight hours and the test was performed at the end of the starvation period. They were then allowed to feed and were tested again. The feeding had apparently no effect upon the result of the globulin precipitation test. The food consisted of grass and oats. It was to be expected that the small amount of protein contained in this kind of food would have little effect upon the result of the test in an herbivorous animal.

Other factors were studied which may, theoretically speaking, be expected to have a possible influence upon the result of the globulin precipitation test. The factors of narcosis (Table 6) and of intraperitoneal injection (Table 7) of a large amount of physiologic salt solution, as well as of repeated bleeding were studied (Table 9). It can be seen from the tables that the effect of narcosis with ether was nil in rabbits. Intraperitoneal injection, however, very likely due to the early exudation of the liquid portion of the blood into the peritoneum, influenced the reaction distinctly in such a way that positive precipitation was noticed in a lower dilution of fresh serum six hours after intraperitoneal injection than immediately before the injection.

Rabbits 1 and 2 (Table 7) were examined before and after intraperitoneal injection of 20 cubic centimeters of physiologic salt solution. Six hours after the injection the result of the reaction was the shifting of the precipitation toward the end of higher concentration.

Rabbit 7 (Table 8) was fed 10 cubic centimeters of horse serum. The globulin precipitation test of the rabbit serum was performed two hours before and after feeding. The result was the same in both examinations. The same experiment was applied to rabbit 8. The serum of this animal gave a positive reaction before feeding but a negative reaction six hours after feeding of 10 cubic centimeters of horse serum. Twenty-four hours and seventy-two hours after feeding, the serum of this animal gave a positive reaction.

In the next experiment (Table 9) the influence of successive bleeding upon the globulin reaction was investigated. Rabbits 10, 11, and 12 were bled 4 cubic centimeters of blood each, three times at intervals of five hours and twenty-four hours, respectively. The sera of all three of these rabbits gave a negative reaction on the first bleeding. On the examination of the second bleeding, rabbit 10 gave a negative reaction in all dilutions, but rabbit 11 gave a positive reaction in the dilutions 1: 3, 1: 4, and 1: 5, and rabbit 12 gave the same reaction in dilutions 1: 2 to 1: 5. On the third bleeding the sera of all of these animals gave a positive result in all the dilutions.

CONCLUSIONS

1. The decrease in concentration of salts in the circulating blood causes the globulin precipitation reaction to become stronger.
2. The increase in concentration of salts in the circulating blood brings about a weaker or a completely negative result.
3. The increase of protein in the circulating blood has as a consequence a very strongly positive globulin precipitation reaction.
4. The influence upon the result of the reaction of the increased protein content in the circulating blood can be detected for a much longer time than can the effect upon the reaction of the increased or decreased salt content in the circulating blood.
5. The influence of general anæsthesia, starving, and feeding upon the result of the reaction in herbivorous animals is not perceptible. Exudation, however, into serous cavities produces increase in strength of the globulin precipitation reaction.
6. The administration, as a food, of protein by mouth to herbivorous animals does not influence the result of globulin reaction.
7. Repeated bleeding at relatively short intervals also influences the result of the reaction in a positive direction.

ACKNOWLEDGMENT

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TABLE 1.—*Showing the result of the globulin precipitation test in rabbit 1.*

		Dilution of serum.				
		1 : 1	1 : 2	1 : 3	1 : 4	1 : 5
Before injection	H_2O	—	—	—	—	—
	Ph.S.S.[a]	—	—	—	—	—
After injection per venam of 10 cc hypotonic (0.45 per cent) NaCl, July 14	H_2O	±	+	+	+	+
	Ph.S.S	—	—	—	—	—
After injection of 10 cc normal horse serum, July 15	H_2O	±	+	+	+	+
	Ph.S.S.	±	+	+	+	+
Six days after injection of horse serum, July 21	H_2O	—	+	±	±	+
	Ph.S.S.	—	—	—	—	—
Two weeks after injection of horse serum, July 29	H_2O	±	±	+	+	+
	Ph.S.S.	—	—	—	±	±
Before injection, July 31	H_2O	—	—	+	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 per cent NaCl	H_2O	—	—	—	—	—
	Ph.S.S.	—	—	—	—	—

[a] Physiologic salt solution.

TABLE 2.—*Showing the result of the globulin precipitation test in rabbit 2.*

		Dilution of serum.				
		1:1	1:2	1:3	1:4	1:5
Before injection, July 16	H_2O	—	—	±	+	+
	Ph.S.S.	—	—	±	±	±
After injection of 10 cc of 0.45 per cent NaCl solution, July 21	H_2O	—	±	±	+	+
	Ph.S.S.	—	—	—	—	—
Before injection of horse serum, July 22	H_2O	—	—	—	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc horse serum	H_2O	±	+	+	+	+
	Ph.S.S.	—	—	±	±	±
Six days after injection of horse serum, July 29	H_2O	+	+	+	+	+
	Ph.S.S.	±	+	+	+	+
Before injection, July 31	H_2O	—	±	±	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc of 10 per cent NaCl, July 31	H_2O	—	—	—	±	±
	Ph.S.S.	—	—	—	—	—

TABLE 3.—*Showing the result of the globulin precipitation test in rabbit 3.*

		Dilution of serum.				
		1:1	1:2	1:3	1:4	1:5
Immediately after injection 0.45 per cent NaCl, July 22	H_2O	—	—	+	+	+
	Ph.S.S.	—	—	—	—	—
Before injection of 10 cc of horse serum, July 23	H_2O	—	—	+	+	+
	Ph.S.S.	—	—	—	—	—
Twenty-four hours after injection of 10 cc of horse serum, July 24	H_2O	—	—	—	±	±
	Ph.S.S.	—	—	—	—	—
Seven days after injection of 10 cc of horse serum, July 31	H_2O	—	+	+	+	+
	Ph.S.S.	—	—	—	—	±
Immediately after injection of 10 cc of 10 per cent NaCl	H_2O	—	—	±	±	±
	Ph.S.S.	—	—	—	—	—

TABLE 4.—*Showing the result of the globulin precipitation test in rabbit 5.*

		Dilution of serum.				
		1:1	1:2	1:3	1:4	1:5
Before injection of 10 per cent NaCl, July 24	H_2O	—	+	+	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc of 10 per cent NaCl, July 27	H_2O	—	—	—	—	—
	Ph.S.S.	—	—	—	—	—
Four days after injection of 10 per cent NaCl, July 31	H_2O	—	±	±	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc of concentrated horse serum August 5 [a]	H_2O	±	+	+	±	—
	Ph.S.S.	—	+	+	+	+

[a] About 40 cubic centimeters of horse serum were placed forty-eight hours in a desiccator which was connected with a vacuum, and concentrated to the amount of about 5 cubic centimeters, and then 10 cubic centimeters of distilled water were added to make the serum liquid. As the concentrated serum was flaky, it was filtered through cotton by means of a sterilized funnel and 11 cubic centimeters of filtrate were obtained.

TABLE 5.—*Showing the result of the globulin precipitation test before and after feeding.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
1	Before feeding, after starving twenty-four hours	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
1	Immediately after feeding, after starving twenty-four hours	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—
2	Before feeding, after starving two days	H_2O	—	—	+	±	±
		Ph.S.S.	—	—	—	—	—
2	Immediately after feeding	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Before feeding, after starving two days	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Immediately after feeding	H_2O	—	—	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 6.—*Showing the result of the globulin precipitation test before and after narcosis.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
1	Before narcosis	H_2O	±	+	+	+	+
		Ph.S.S.	—	—	—	—	—
1	Immediately after narcosis (ether)	H_2O	—	±	±	±	±
		Ph.S.S.	—	—	—	—	—
2	Before narcosis	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
2	Immediately after narcosis (ether)	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Before narcosis	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Immediately after narcosis (ether)	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
6	Before narcosis	H_2O	—	—	±	+	+
		Ph.S.S.	—	—	—	—	—
6	Immediately after narcosis (ether)	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 7.—*Showing the result of the globulin precipitation test before and after intraperitoneal injection of 20 cubic centimeters of physiologic salt solution.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
1	Before injection	H_2O	—	—	±	+	+
		Ph.S.S.	—	—	—	—	—
1	Six hours after injection of 20 cc Ph.S.S. intraperitoneally	H_2O	±	±	+	+	+
		Ph.S.S.	—	—	—	±	±
2	Before injection	H_2O	—	—	—	±	+
		Ph.S.S.	—	—	—	—	—
2	Six hours after injection of 20 cc Ph.S.S. intraperitoneally	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 8.—*Showing the result of the globulin precipitation test before and after feeding with 10 cubic centimeters of horse serum.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
7	Before feeding	H_2O	—	—	+	+	+
		Ph.S.S.	—	—	—	—	—
7	Two hours after feeding with 10 cc of horse serum	H_2O	—	—	+	+	+
		Ph.S.S.	—	—	—	—	—
8	Before feeding	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—
8	Six hours after feeding with 10 cc of horse serum	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
8	Twenty-four hours after feeding with horse serum	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—
8	Seventy-two hours after feeding with horse serum	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 9.—*Showing the result of the globulin precipitation test after repeated bleeding.*

Rabit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
10	First bleeding, 8 a. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
10	Second bleeding, 1 p. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
10	Third bleeding, 8 a. m., March 30	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
11	First bleeding, 8 a. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
11	Second bleeding, 1 p. m., March 29	H_2O	—	—	±	+	+
		Ph.S.S.	—	—	—	—	—
11	Third bleeding, 8 a. m., March 30	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—
12	First bleeding, 8 a. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
12	Second bleeding, 1 p. m., March 29	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
12	Third bleeding, 8 a. m., March 30	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—

SALTS OF LINOLENIC HEXABROMIDE FROM LUMBANG OIL

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The glycerides of linolenic, linolic, and oleic acids occur naturally in vegetable drying oils. These unsaturated glycerides, particularly linolenic and linolic, are the substances that absorb oxygen from the air and cause the oil to dry.

The commercial value of an oil suitable for the manufacture of paint and varnish depends on its drying power, which is really the oxygen-absorbing capacity of the particular unsaturated compounds contained in the oil. Previous experiments[1] carried out on the oxidation of Philippine lumbang oil showed that linolenic glyceride was oxidized more readily than was linolic glyceride; also, the latter absorbed oxygen more rapidly than did oleic glyceride.

Linolenic glyceride has a greater capacity for the absorption of oxygen than has any of the other compounds contained in drying oils. This glyceride and the corresponding free linolenic acid are, therefore, substances of considerable importance, since the amount of this glyceride present in a drying oil determines to a considerable extent the commercial value of the oil.

Although linolenic glyceride and the free linolenic acid are substances which oxidize readily, they may be separated from an oil in the form of a stable hexabromide.[2] Since this linolenic hexabromide (hexabrom stearic acid) is a stable form of linolenic compounds, it is an important substance in the chemistry of vegetable drying oils. Only a very few derivatives of this substance (hexabromide) have ever been prepared. Erdmann and Bedford[3] state that they prepared the potassium and barium salts of the hexabromide and also the methyl and ethyl esters, but they do not give the experimental details. Nor do they give the melting point or analysis of the salts.

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[1] West, A. P., and A. I. De Leon, Philip. Journ. Sci. 24 (1924) 123; Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 2 (1922) 42.

[2] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 212.

In view of the fact that very little is known about linolenic hexabromide we thought it might be of interest to make a few salts of this substance and determine their solubility in various organic solvents. The data thus obtained may be useful in devising new methods of analysis and in working out more-accurate separations of mixtures of halogen stearic acids, such as linolenic hexabromide, linolic tetrabromide, and oleic dibromide.

In order to study the chemical behavior of the unsaturated acids (which occur as glycerides in drying oils), or to make pure derivatives of these acids, it is necessary to separate each individual acid from the mixture of substances contained in the oil. The method commonly used is to decompose the glycerides and convert them into a mixture of free unsaturated acids. Since the unsaturated acids absorb oxygen readily when exposed to the air, they are treated with bromine and converted into the mixed bromo addition products[4] (linolenic hexabromide, linolic tetrabromide, and oleic dibromide). The mixed bromides are very stable substances. Both the hexabromide and the tetrabromide may be separated from the dibromide and from each other by treatment with solvents, and they may be converted back again into the free acids by reduction[5] with zinc in alcoholic solution. Thus it is possible experimentally to separate from an oil, such as lumbang, individual unsaturated acids and to study the chemistry of these acids and their derivatives.

EXPERIMENTAL PROCEDURE

In preparing a supply of linolenic acid hexabromide for our experiments, we used Philippine lumbang oil, which is a drying oil used in making paints, varnishes, and similar products.[6] The lumbang oil we used was pressed from nuts of good quality and filtered first through glass wool and then through filter paper. Lumbang oil consists almost entirely of glycerides[7] of the unsaturated acids, linolenic, linolic, and oleic. It serves as excellent material for preparing linolenic and linolic acids and their derivatives. When lumbang oil is decomposed and the glycerides are converted into mixed unsaturated acids and these mixed acids brominated in ether solution, linolenic hexabromide is precipitated according to the following equation:

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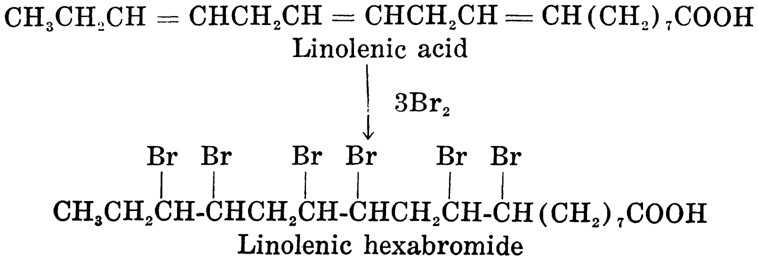
[3] Ber. Deut. Chem. Gesell. 42 (1909) 1324.

[4] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 585.

[5] Ibid 1 (1921) 201, 202, and 210.

[6] West, A. P., and F. L. Smith, Bull. P. I. Bur. Forestry 24 (1923).



$$CH_3CH_2CH = CHCH_2CH = CHCH_2CH = CH(CH_2)_7COOH$$

Linolenic acid

$$\Big\downarrow 3Br_2$$

$$CH_3CH_2\overset{\overset{Br}{|}}{C}H\text{-}\overset{\overset{Br}{|}}{C}HCH_2\overset{\overset{Br}{|}}{C}H\text{-}\overset{\overset{Br}{|}}{C}HCH_2\overset{\overset{Br}{|}}{C}H\text{-}\overset{\overset{Br}{|}}{C}H(CH_2)_7COOH$$

Linolenic hexabromide

Linolenic acid hexabromide.—Freshly prepared lumbang oil was saponified with aldehyde-free alcoholic potassium hydroxide in batches of 530 grams each. The resulting soaps were converted into mixed unsaturated acids which were extracted with ether and the ether solution was dehydrated with sodium sulphate. The ethereal solution of mixed acids, containing about 500 grams of acids, was poured into a 5-liter flask and diluted with redistilled ether to a volume of 4 liters. The flask containing the acids was immersed in a freezing bath of ice, salt, and water. The solution of mixed acids was stirred mechanically by means of a hot-air motor, and brominated according to the method of Eibner and Muggenthaler.[8] When the thermometer immersed in the acid solution registered —10° C. or below, a slight excess of the calculated quantity of bromine (135.3 cubic centimeters of specific gravity 3.12) was allowed to drop rather rapidly into the acid solution from a dropping funnel, the end of which was drawn out to a rather fine opening. The temperature of the acid solution was not allowed to rise above —5° C. In about three hours the required amount of bromine was added to the acid solution. To complete the reaction the mixture was allowed to remain in the ice bath and the stirring continued for about two hours longer. The reaction product was then filtered to separate the insoluble hexabromide. The hexabromide was washed thoroughly with ether until white and then dried on layers of filter paper.

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[7] West, A. P., and Z. Montes, Philip. Journ. Sci. 18 (1921) 619.

[8] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 585.

When the unsaturated acids of lumbang oil are brominated at a low temperature, and especially in dilute solution, sticky products are not formed so readily as when the bromination is carried out in a more concentrated solution. It is also advisable to use a very slight excess of bromine, so that when the reaction is complete the mixture has a slightly yellow color. Incomplete bromination usually gives a reaction product that is somewhat oily and does not filter well.

To purify the linolenic hexabromide, samples of about 40 grams were washed thoroughly with ether, after which the hexabromide was crystallized, in small portions, first from ethyl acetate and then from benzene. After each crystallization the acid was filtered through a Buchner funnel with the aid of a partial vacuum and then washed well with ether, dried, and powdered. After standing in a vacuum desiccator for some hours the melting point was determined and found to be 179.5° C. to 180.5° C.

The acid was analyzed by determining the bromine content. This was done by boiling about 0.1 gram of the substance with a concentrated aqueous solution of silver nitrate (containing about 0.5 gram of silver nitrate) and 30 cubic centimeters of pure concentrated nitric acid. The precipitated silver bromide was collected on a Gooch crucible.

Analysis of linolenic hexabromide.

[0.1388 gram of sample gave 0.2078 gram silver bromide.]

	Bromine. Per cent.
Calculated for $C_{18}H_{30}Br_6O_2$	63.27
Found	63.71

In endeavoring to make derivatives of linolenic hexabromide, considerable difficulty was experienced, because the acid is rather insoluble in the ordinary organic solvents and it is necessary to work with very dilute solutions. Linolenic hexabromide does, however, dissolve to a certain extent in various solvents such as benzene, benzyl alcohol, ethyl acetate, xylene, pyridine, and the propyl and butyl alcohols.

Salts of linolenic hexabromide were prepared by first converting the acid into the potassium salt. A methyl alcohol solution of the potassium salt was then treated with a methyl alcohol solution of an inorganic salt such as barium bromide. The precipitated salt thus obtained was purified and the melting point and solubility in various solvents were determined. The lead salt was, however, prepared directly from the free linolenic hexabromide.

Potassium salt of linolenic hexabromide.—Ten grams of linolenic hexabromide were dissolved in about 250 cubic centimeters of hot benzyl alcohol. To the clear solution 12 cubic centimeters of hot alcoholic potassium hydroxide solution (1 cubic centimeter = 0.061994 gram potassium hydroxide) containing a very slight excess of the calculated amount of potassium hydroxide, were added with vigorous shaking. The potassium salt of the hexabromide was thrown down as a white, gelatinous precipitate. About 200 cubic centimeters of absolute alcohol were then added and the mixture heated (reflux) on a water bath for about five hours. The mixture was cooled, the supernatant liquid poured off, and the salt washed well with ether by decantation in order to remove all the benzyl alcohol. If the benzyl alcohol is not entirely removed, the salt is somewhat oily and difficult to dry.

In order to purify the potassium salt, it was washed with hot benzene to dissolve any unchanged hexabromide which might be present. The salt was then washed with ether and dried in a desiccator. Experiments showed that it is not desirable to dry salts of the hexabromide in an oven at 80° C., because continued heating tends to turn them somewhat brown, due to slight decomposition.

A determination of the melting point showed that at 180° C. the salt begins to turn slightly brown and that it melts, with decomposition, to an opaque brown liquid at 185° C. to 190° C.

In preparing the potassium salt, propyl alcohol, isopropyl alcohol, and isobutyl alcohol can be used in place of benzyl alcohol to dissolve the hexabromide. However, the acid is not so soluble in these solvents as in benzyl alcohol, so that about 500 cubic centimeters are required for each 5 grams of the acid and the solution is turbid.

Analysis of potassium salt of linolenic hexabromide.

[0.1569 gram salt gave 0.2200 gram silver bromide.]

	Bromine. Per cent.
Calculated for $C_{18}H_{29}Br_6O_2K$	60.25
Found	59.67

Barium salt of linolenic hexabromide.—Five grams of the potassium salt of linolenic hexabromide were dissolved in about 3 liters of hot methyl alcohol and filtered. The solution was then heated again on a water bath. A solution of barium bromide was prepared by dissolving the salt in about 5 cubic centimeters of water and adding 100 cubic centimeters of methyl alcohol. This solution of barium bromide, containing about 2.3 grams of the salt, was heated and then added with constant shaking to the hot alcoholic solution of the potassium salt. A white precipitate was formed immediately. The mixture was divided into two portions which were heated (reflux) for about nine hours. The liquid above the precipitate was then perfectly clear, an indication that the reaction was complete. The whole mixture was distilled to a volume of about 500 cubic centimeters, after which it was allowed to cool, and then thrown into about 1.5 liters of water, stirred, and filtered immediately. This treatment with water removed the potassium bromide and also the excess barium bromide, as shown by the bromide test with silver nitrate. The residue was washed with methyl alcohol and ether. It was then dried on layers of filter paper, powdered, and placed in a desiccator.

A melting point determination showed that, without crystallization, the barium salt of linolenic hexabromide turned slightly brown at 197° C., and became a brownish black mass at 200° C. without melting completely.

The formula of the salt was checked by determining the percentage of barium. A weighed quantity of the salt, placed in a porcelain crucible, was treated with a few drops of concentrated sulphuric acid and heated gently by heat reflected from a hot asbestos board placed above the crucible. In this way spattering of material was avoided. After ignition with a Bunsen flame the barium was weighed as barium sulphate.

Analysis of barium salt of linolenic hexabromide.

[0.5160 gram of the salt gave 0.0726 gram barium sulphate.]

	Barium. Per cent.
Calculated for $C_{36}H_{58}Br_{12}O_4Ba$	8.32
Found	8.28

Zinc salt of linolenic hexabromide.—The zinc salt of linolenic hexabromide was prepared in the same way as the barium salt by mixing a hot solution of the potassium salt of linolenic hexabromide in methyl alcohol with a hot solution of zinc chloride in methyl alcohol (95 per cent). A white flocculent precipitate was formed. The mixture was then heated (reflux) until the methyl alcohol above the precipitate was completely clear, after which it was distilled to about one-sixth its volume and then allowed to cool. The precipitate was thrown into water, stirred, and filtered immediately. It was washed with methyl alcohol and ether, and then dried.

A melting point determination showed that, without crystallization, the salt decomposed sharply at 174° C.

The formula of the salt was checked by analysis in the same manner as was the formula of the barium salt. A weighed quantity of the salt was converted into zinc sulphate by treating it with sulphuric acid. The zinc sulphate was then heated and weighed as zinc oxide.

Analysis of zinc salt of linolenic hexabromide.

[0.6139 gram of the salt gave 0.0292 gram zinc oxide.]

	Zinc. Per cent.
Calculated for $C_{36}H_{58}Br_{12}O_4Zn$	4.14
Found	3.82

Lead salt of linolenic hexabromide.—Five grams of linolenic hexabromide were dissolved in about 500 cubic centimeters of boiling ethyl acetate. To the clear acid solution there was added with constant shaking a boiling, turbid, alcoholic solution of normal lead acetate, containing a slight excess of the calculated amount of the salt. A white flocculent precipitate was formed. The mixture was heated (reflux) until the solution above the precipitate was completely clear. It was then distilled to about one-third the volume, thrown into water, and the mixture stirred and filtered. The residue was washed thoroughly with alcohol and ether, and then dried.

When the melting point was determined the salt turned slightly brown at 160° C., and melted, with decomposition, at 190° C. to 195° C.

Analysis of lead salt of linolenic hexabromide.

[0.2536 gram of salt gave 0.0452 gram lead sulphate]

	Lead. Per cent.
Calculated for $C_{36}H_{58}Br_{12}O_4Pb$	12.04
Found	12.18

Solubility.—Qualitative solubility experiments on the free linolenic hexabromide and the salts that we prepared were made at room temperature (about 30° C. and designated as cold), and also in hot solvents. For low-boiling solvents like acetone, the solubility in hot solution was determined at the boiling temperature of the solvent. With high-boiling solvents, such as xylene, the temperature for solubility determination was about 90° C. In reporting the qualitative solubility data, the term "soluble" is used for solvents which dissolve the acid or the salts to the extent of about 1 to 4 per cent. For solubility below 1 per cent the terms "insoluble" or "slightly soluble" are used. The term "very soluble" is used when about 5 per cent or more of the acid or the salts is dissolved.

TABLE 1.—*Solubility of linolenic hexabromide and some of its salts in different solvents.*

[I=insoluble; ss=slightly soluble; S=soluble; VS=very soluble.]

Solvent.	Hexabromide.		Potassium salt.		Barium salt.		Zinc salt.		Lead salt.	
	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.
Acetic acid, glacial	ss	S	ss	S	ss	S	ss	S	ss	VS
Acetone	I	ss	I	ss	ss	ss	ss	ss	I	I
Amyl alcohol	ss	VS	I	ss	I	I	I	I	I	I
Amyl nitrate	ss	S	I	I	I	ss	I	I	I	I
Benzaldehyde	ss	VS	ss	VS	ss	VS	ss	VS	ss	VS
Benzene	ss	S	I	I	I	I	ss	ss	I	I
Benzyl alcohol	ss	VS	I	ss	I	S	I	S	I	S
Chloroform	I	ss	I	I	I	I	I	ss	I	I
Carbon tetrachloride	I	ss	I	I	ss	ss	I	ss	I	I
Ether	ss	ss	I	I	I	I	I	ss	I	I
Ethyl alcohol	ss	ss	ss	ss	I	ss	I	ss	ss	ss
Ethyl acetate	ss	S	I	ss	I	ss	I	ss	ss	ss
Ethyl benzoate	ss	VS	I	ss	I	I	I	ss	I	ss
Ethyl bromide	ss	ss	I	I	ss	ss	ss	ss	ss	ss
Ethylene bromide	ss	VS	ss	ss	ss	ss	ss	ss	ss	ss
Isopropyl alcohol	ss	ss	ss	ss	I	I	I	I	I	I
Isobutyl alcohol	ss	S	ss	ss	ss	ss	ss	ss	ss	ss
Ligroin	I	I	I	I	I	I	I	I	I	I
Methyl alcohol	ss	ss	ss	ss	ss	ss	ss	ss	ss	ss
Methyl salicylate	ss	VS	I	ss	I	I	I	ss	ss	ss
Nitro benzene	I	VS	I	I	I	I	I	S	I	S
Propyl alcohol (*n*)	ss	S	ss	S	ss	ss	ss	ss	I	ss
Petroleum ether	I	I	I	I	I	I	I	I	I	I
Pyridine	VS	VS	I	I	I	ss	ss	VS	ss	ss
Toluene	ss	S	I	I	I	I	I	I	I	I
Terpinol	ss	VS	I	I	I	ss	I	ss	I	ss
Xylene	ss	VS	I	I	I	I	I	I	I	I
Water	I	I	I	I	I	I	I	I	I	I

As shown by the solubility data given in Table 1, linolenic hexabromide and the salts prepared from it are not very soluble in the ordinary organic solvents. Experiments showed that about 10 grams of the acid will dissolve in 200 cubic centimeters of benzyl alcohol at 100° C. Five grams of the acid will dissolve in 500 cubic centimeters of warm isobutyl alcohol, and 21 grams of acid will dissolve in 400 cubic centimeters of warm xylene.

Although linolenic hexabromide is somewhat soluble in various solvents, salts of the acid are mostly insoluble or only slightly soluble. All of them, however, are soluble in hot benzaldehyde and glacial acetic acid. The barium salt is soluble in hot benzyl alcohol; the zinc salt dissolves in hot benzyl alcohol, nitro benzene, and pyridine; and the lead salt is soluble in hot benzyl alcohol and nitro benzene. Hot normal propyl alcohol dissolves the potassium salt.

Melting point.—A determination of the melting point of the salts showed that they all decompose when heated to a sufficiently high temperature. This is not surprising since, according to the literature,[9] various salts of long-chain aliphatic acids do not give a sharp melting point.

Several salts of acids such as myristic, palmitic, daturic, and stearic have been prepared by other investigators, but the melting-point data [10] of these salts are not recorded in the usual reference books.

Of the various salts that we prepared the zinc salt seemed to give the best melting point, although it melted sharply with decomposition.

In this connection it may be noted that, of the various salts prepared from linolenic and linolic acids, the zinc salt [11] appears to be the most stable.

SUMMARY

A considerable quantity of linolenic hexabromide (melting point, 179.5° C. to 180.5° C.) was prepared.

The lead salt of linolenic hexabromide was prepared by treating a solution of the free acid with an alcoholic solution of lead acetate.

The potassium salt of linolenic hexabromide was prepared by neutralizing the free acid, dissolved in an organic solvent, with an alcoholic solution of potassium hydroxide.

From the potassium salt of linolenic hexabromide, the barium and zinc salts were prepared.

The solubility of linolenic hexabromide and of the postassium, barium, zinc, and lead salts of this acid was determined for various solvents. The melting point of these compounds was also determined.

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[9] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 156, 157, 160, 163, 172, 175, 191, 192, 200, 204; Beilstein's Handbuch der organischen Chemie, Vierte Auflage, 2 (1920) 361, 369, 372, 395, 396, 473; Caspari, C. E., Am. Chem. Journ. 27 (1902) 307, 310.

[10] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 160, 163, 165, 168, 169, 191; Beilstein's Handbuch der organischen Chemie, Vierte Auflage, 2 (1920) 365, 372, 379, 387, 465, 496.

[11] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 213; Reformatzky, A., Journ. für Prak. Chem. 41 (1890) 537.

BRACONIDÆ-CHELONINÆ OF THE PHILIPPINES, MALAYA, AND AUSTRALIA[1]

I. CHELONINI (EXCEPT CHELONUS)

By CHARLES FULLER BAKER
Of Los Baños, Philippine Islands

Field work in Malaya and the Philippines, extending through fourteen years, shows this important group to be highly developed, and abundant everywhere in these regions in both species and individuals. There have been described previously from the entire Orient (southeast Asia, the Malayan, Moluccan, and Papuan Archipelagoes, and Australia) some fifty species in the subfamily Cheloninæ; but it is not difficult to find more than that number in any one good locality in the Philippines—practically all unknown up to this time. Some members of the group play a very large part in the economy of Nature, as for instance in the case of a *Chelonus* described below which may easily be reared by thousands from *Crocidolomia binotalis* at Los Baños.

This group presents an excellent example of the fact that a classification of sorts may be a very ready possibility when but a few specimens of a few species are known, but that often it becomes very difficult with large series of specimens and species. Such series may show at once that some of the characters previously used for separation of species and even genera are highly variable, and cannot be employed for such purposes. Coloration is highly variable and descriptions based only on color characters are usually quite useless. For instance, bred series show that some species, with the abdomen yellow-marked in the female, have entirely black males; also that the extent of black markings in largely ferruginous species is highly variable. At the same time, the range of coloration in the subfamily is not great and many species are practically identical in coloration. Also, in certain structural characters there is often wide variation, as in some of the minuter details of the very coarse sculpturation. For the same reason, certain details of wing venation cannot be used for synoptical purposes. The insertion of the recurrent nervure is highly variable and may vary from interstitial to distinctly entering the first or second cubital cell, in the same species. In the female, antennæ of sixteen joints are rather regularly of this number, but both male and female antennæ of more-numerous joints are usually variable by several joints more or less. The dentation of the apex of the abdomen is a sexual character, as is also the elongation of the palpi. In some genera the antennæ in the female (especially when sixteen-jointed) are shorter and more terete than in the male, but in other cases are very similar to those of the male. Thus, the characters given for *Arichelonus* Viereck, *Microchelonus* Szepl., *Chelonella* Szepl., *Bitomus* Szepl., and *Neophanerotoma* Szepl. are either merely sexual characters of scarcely group value, or characters that vary widely in every possible combination among closely related species. In a large series of species of tropical oriental *Phanerotoma,* the characters given by Szepligeti for *Neophanerotoma* have no generic value, occurring in every possible gradation and combination.

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[1] Of this series covering certain groups of the ichneumonoid parasites, the paper on the Rhogadinæ (except *Rhogas*), was published in Philip. Journ. Sci. § D 12 (1917) 281–327. The second paper, on the genus *Rhogas*, was published in Philip. Journ. Sci. § D 12 (1917) 383–422.

Gastrotheca Guerin has a cyclostomatous mouth and must be referred to the cyclóstomine series as noted by Brues.[2] The true position of *Trachypetus* Guerin, described from Australia as having a petiolate abdomen, is also problematical.

An attempt is made herein to arrange the material now in hand. Certain very strongly divergent types which do not appear to be referable to any older genera are here separated as distinct genera, the ensemble of characters of diagnostic value being entirely distinctive; but extensive new material from New Guinea, Central Africa, or some other unexplored region may submerge these, just as the present extensive material renders *Neophanerotoma* and certain others quite meaningless.

In the following descriptions an attempt is made to consider only characters of diagnostic value, and to avoid unnecessary detailing of characters common to the subfamily, the tribe, or the genus. Thus the palpi are generally, throughout the subfamily, stramineous or yellowish in color and exceptions are very rare, there being only two among the species mentioned in this paper; namely, *Ascogaster palpalis* Szepligeti and *A. intensus* sp. nov. Also, as a general rule, the second transverse cubital nervure is decolored and commonly suffused with whitish; in only four of the species herein is it fully colored: namely, *Megachelonus uniformis* sp. nov., *M. bicoloricornis* sp. nov., *Ascogaster inconspicuus* sp. nov., and *A. luzonensis* sp. nov. In the vast majority of species the hind coxæ are smooth, with sparse minute punctures; only in the genus *Cascogaster* are they more heavily sculptured. All species are clothed with more or less of usually whitish pubescence; ordinarily this is denser on face, pleuræ, apex of abdomen, and tibiæ and tarsi; usually it does not offer any very clear diagnostic distinctions, though it does so rarely, as in *Megachelonus*.

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[2] Ann. S. Afr. Mus. 19 (1924) 76.

Synopsis of tribes of Cheloninæ.

*a*¹. Abdominal sutures obsolete, the tergum a solid carapace........ **Chelonini.**

*a*². Abdomen usually with two distinct sutures (the second said to be obsolete in *Bitomus*); first abscissa of cubitus always present.

  *b*¹. Abdomen shorter than head and thorax together, not strongly elongately narrowed basally, but subelliptical in outline, the third segment not broader than the quadrate second; second cubital cell never elongate rectangular, usually subtriangular; head subcubical .... **Phanerotomini.**

  *b*². Abdomen longer than head and thorax together, strongly narrowed basally, clavate in outline, the third segment greatly enlarged, broader than the long trapezoidal second segment and very broadly rounded and deep apically; second cubital cell usually elongate rectangular; head very strongly transverse.................... **Sigalphini.**[3]

Synopsis of genera of Indo-Malayan-Australian Chelonini.[4]

*a*¹. First abscissa of cubitus obsolete, first cubital and first discoidal cells therefore confluent; eyes pubescent.

  *b*¹. Viewed from above the interocular width is but little greater than the width of an eye and the front is distinctly convexly extended beyond eyes; head cubical, genæ broad above and back of the eyes, the antennal scrobes distant from occipital margin; posterior face of propodeum not separated from superior face by a transverse rim; thorax and abdomen strongly elongate, though otherwise of normal *Chelonus* form; the abdomen subparallel-sided and distinctly larger than thorax; first abscissa of radius distinctly short or shorter than second; nervulus very far postfurcal (to ⅓ to ⅔ of first abscissa of discoidal); antennæ (female) 36-, (male) 45-jointed; size medium to large................................ **Cubochelonus g. nov.**

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[3] Includes *Sigalphus* Ill. (= *Sphaeropyx* Ill.). The "*Sigalphus*" of later authors is *Triaspis* Hal. (Triaspinæ).

[4] *Trachypetus* Guerin of Australia is not included in this tribe.

b^2. Viewed from above, the interocular width is always distinctly greater than the width of an eye and the front is little if any extended; head distinctly transverse, genæ strongly narrowed above, the antennal scrobes reaching near to occipital margin; posterior face of propodeum always separated from superior face by a transverse rim.

c^1. Head large, markedly transversely subquadrate because of very prominent eyes, and much broader than thorax; the vertex usually distinctly concave between eyes; inner orbits usually rapidly diverging apicad; stigma very large and broad; first abscissa of radius as long as or longer than second; nervulus shortly postfurcal (to $\frac{1}{5}$ first abscissa of discoidal); male carapace with apical aperture and more or less acute apically; female usually with apical teeth, the ventral cavity being extended to apex; middle of tergum also distinctly costulate; antennæ (female) 16-jointed.................................... **Megachelonus** g. nov.

c^2. Head normal (for *Chelonus*); eyes not at all prominent; inner orbits subparallel; stigma normal; antennæ (female) 16-jointed (in Malayan species).. **Chelonus** Jurine.

a^2. First abscissa of cubitus present; eyes naked.

b^1. First transverse cubital straight or nearly so; first abscissa of radius usually as long as or longer than second abscissa; nervulus far postfurcal; stigma short and deep; prestigma strongly developed; subdiscoidal nervure arising near apex of discoidal.

c^1. Median ocellus far in advance of lateral; head always sculptured very differently from mesonotum; mesonotum rather broadly rounded apically; neither lateral nor apical borders of scrobes with largely developed denticles; none of present species with acutely pointed abdomen, the ventral cavity in all cases broadly reaching apex; transverse rim of propodeum without large teeth, such teeth small or wanting; cubitus arising from prestigma; abdomen always shorter than head and thorax together (as to Malayan species)................................ **Ascogaster** Wesmael.

c^2. Median ocellus vertical and standing partly within line of lateral ocelli; head grossly areolate, like mesonotum; mesonotum somewhat longer and distinctly narrowed apicad, not broadly rounded; lateral or apical borders of scrobes with largely developed denticles; abdomen acutely pointed, the ventral concavity falling far short of reaching apex; raised transverse rim of propodeum with strongly extended teeth of great size; cubitus issuing from basal vein far from prestigma; abdomen as long as head and thorax together; propodeum grossly quadridentate.
Cascogaster g. nov.

b^2. First transverse cubital strongly arched toward stigma; first abscissa of radius distinctly shorter than second; nervulus very shortly postfurcal; stigma long lanceolate; prestigma subobsolete but cubitus arising here; subdiscoidal nervure arising far above apex of discoidal; very large, slenderly elongate species, with extended, teatlike apex of carapace; in both male and female, abdomen longer than head and thorax together; propodeum unarmed.
Megascogaster g. nov.

Genus **CUBOCHELONUS** novum

This segregate differs from *Chelonus* as stated in the synopsis above. The cubical head and strongly elongate form at once distinguish it. Of Cheloninæ with eyes not at all prominent, none have the genæ above and the occipital region so strongly developed; the distance from superior orbit to occipital margin about equals the width of eye. Although not at all prominent, the eyes are large and distinctly long elliptical; malar space not half length of eye. Maxillary palpi 5-jointed, last four joints long and slender, progressively slenderer, subequal in length, reaching to fore coxæ. Labial palpi 4-jointed, second joint strongly swollen, roundly extended apically beyond insertion of third which is a little swollen apically and one-half length of fourth. The posterior face of propodeum is not separated from the superior surface by a transverse carinate ridge, and the surface is evenly sloping from metanotum to insertion of abdomen; abdomen broadly rounded as in *Chelonus*, the ventral cavity not reaching apex. The straight sides of abdomen are characteristic of both sexes. Prosternum very long, nearly twice the length of fore coxæ, uniformly coarsely foveolate, medially fine sulcate.

Type, *Cubochelonus luzonicus* sp. nov.

In fourteen years of collecting no representatives of this genus have been encountered elsewhere than on Mount Maquiling, central Luzon.

Synopsis of species of Cubochelonus g. nov.

a^1. Prestigma yellowish; wing conspicuously white-banded at middle; abdomen broadly yellow-banded on basal half.......... **C. luzonicus** sp. nov.
a^2. Prestigma black, wing hyaline basally but not white fasciate at middle; abdomen black above.......... **C. tagalicus** sp. nov.

Cubochelonus luzonicus sp. nov.

Length, female, 6.5 millimeters; male, 5.

Female.—Black; abdomen on basal half with a broad yellowish transverse band, this band straight-edged posteriorly, anteriorly irregular and not reaching base; antennæ with scape, annellus, and base of third joint ferruginous, remainder piceous. Mandibles ferruginous. Wings deeply infumated apically, stigma and veins dark, prestigma yellowish, a white transverse fascia extending across the wing from prestigma; in this band the recurrent nervure and second abscissa of discoidal are white; extreme base of median vein and second transverse cubital decolored. The male differs in having the abdominal band somewhat obscured, more of the flagellum basally ferruginous, the fore legs entirely ferruginous, the middle legs with ferruginous tarsi, tibiæ, and apices of femora, and the hind legs with ferruginous tarsi and a pale annulus near base of tibiæ. Short silvery pile thicker on legs and thorax. General color of wing paler, veins paler.

Clypeus in female rather strongly and closely punctate, anterior margin medially short toothed. Face coarsely rugose-punctate, above with a short broad sulcus between bases of antennæ; scrobes rather deeply excavated, smooth, shining, and remotely large punctate within, no median carina, carinately rimmed only below. Genæ obliquely coarsely rugose-punctate. Vertex with irregular crowded punctures and pits of very variable size, the rugæ separating them smooth and shining. Mesonotum medially on basal half with very large crowded foveolæ, those at extreme base longitudinally arranged, and with a line of such foveolæ marking the course of notauli; lateral areas and the anterior half shining and with separated coarse punctures. Scutellum with small separated punctures medially, anteriorly septemfoveate. Propodeum entirely, very coarsely, deeply, and uniformly foveolate, including the posterior face—as are also the mesopleuræ. Carapace with the humeral angles sharply prominent and the humeral ridges extending straight caudad, between them some six equally strong costulæ; on posterior two-thirds of tergum the sculpturation becomes a rather fine rugulose foveolation without longitudinal trend, the foveolæ having crowded secondary pits. Antennæ reaching to middle of tergum, 45-jointed, strongly tapering apically; annellus very short, about one-fourth length of first flagellar joint, the latter not as long as and about half width of scape. The male differs in having the rugosities of face distinctly transverse and the short superior median sulcus absent. Antennæ of same form as in female but 36- to 37-jointed. Rugæ of posterior two-thirds of tergum distinctly longitudinal, ventral cavity reaching much nearer apex than in female. First abscissa of radius distinctly shorter than second, and hardly as long as transverse cubitus. Nervulus postfurcal to one-third of first abscissa of discoidal.

Mount Maquiling, central Luzon (*Baker*).

Cubochelonus tagalicus sp. nov.

Length, female, 6 to 7 millimeters; male, 4.5.

Female.—Black; venter yellowish and this showing through very slightly at sides near base of tergum; antennæ with scape and annellus ferruginous, flagellum piceous; mandibles ferruginous, tips black. Fore legs with tarsi, tibiæ, and apices of femora ferruginous, remainder of femora and coxæ piceous, middle and hind legs except hind coxæ, piceous. Wings moderately infumated on apical half, hyaline from level of stigma to base; stigma and adjoining veins dark, median, discoidal, and recurrent nervures paler; prestigma and basal vein very dark; extreme base of median vein and second transverse cubital decolored. The male differs only in having the middle legs like the fore legs, the femora and coxæ of both being also ferruginous.

Structurally differing from *C. luzonicus* as follows: Clypeus with punctures very variable in size, some of the anterior coalescing into irregular pits; face also with two distinct, short, longitudinal, shallow, submedian depressions which divide the face at middle into thirds; antennæ not so strongly tapering as in *C. luzonicus* and somewhat longer. The male has the clypeus much less strongly punctured, with no punctures coalescing; tergum with basal costulæ fewer and the foveolations between them much larger and deeper. First abscissa of radius distinctly shorter than the rather short second abscissa, the latter subequal to the second transverse cubitus. Nervulus as in *C. luzonicus.*

Mount Maquiling, central Luzon (*Baker*).

Genus **MEGACHELONUS** novum

Viewed from above, the distance between the prominent eyes is much greater than the width of an eye, and the anterior transverse border of face (as seen from above) is nearly straight, the front not at all extended; the face is correspondingly broad, much broader than long; in lateral view the eye is distinctly long elliptical or ovoid, the malar space not as long as an eye is broad, and not greater than half its length. Maxillary palpi similar to those of *Cubochelonus* but, due to the far shorter prosternum, reaching to hind border of fore coxæ. Labial palpi with third joint inserted at apex of the somewhat swollen second. Abdomen not longer than thorax, general form normally chelonoid in female, somewhat spindle-shaped and more or less acute apically in male. Posterior face of propodeum abruptly declivous, concave, separated from upper face by a prominent carinate rim, which is laterally and submedially more or less strongly toothed. Prosternum small, scarcely one and a half times length of fore coxæ, median sulcus broad and deep, flanked by very large foveolæ.

The sexual characters of this group are very marked; the males have a variously shaped apical aperture in the carapace; in the females the ventral concavity usually reaches the apex and there has its bounding apical angles toothed; rarely the ventral cavity does not reach apex and is normally chelonoid.

In all of the species, the thorax has a rather pronounced grayish cast, due to the rather thick coarse appressed pile.

Type, *Megachelonus bidentatus* sp. nov.

Synopsis of species of Megachelonus g. nov.

FEMALES

*a*¹. Abdomen very deep apically and here broadly rounded, not bidentate at apex, the ventral cavity far from reaching apex; midtergal foveolæ small, simply pentangular or sexangular, their rims fine and uniform, forming no connected and distinctly longitudinal costulæ in the middle third; prestigma stramineous; radial cell infuscate; length, 5 millimeters .... **M. areolellus** sp. nov.

*a*². Abdomen of equal depth throughout as seen from side, the ventral cavity reaching apex and there with its terminal lateral angles strongly porrectly dentate; midtergal foveolæ lying between distinctly longitudinal costulæ; wings hyaline.

  *b*¹. Carapace broadly yellow at base; large, stout species; length, 5.75 millimeters .... **M. bidentatus** sp. nov.

  *b*². Carapace black throughout.

    *c*¹. Antennæ 16-jointed; small species, length, 3.5 millimeters; apical opening of ventral cavity distinctly ventral, the apex of carapace roundly out-swollen above it.

      *d*¹. Antennæ with uniformly dark ferruginous flagellum; hind femora entirely pale ferruginous; length, 3.5 millimeters. **M. uniformis** sp. nov.

      *d*². Antennæ with basal half of flagellum pale ferruginous, apical half piceous in strong contrast; hind femora piceous at apices; length, 4 millimeters .... **M. bicoloricornis** sp. nov.

    *c*². Antennæ more than 19-jointed, large species, length, 5.5 millimeters: apical opening of ventral cavity extended upward and occupying whole apex of the narrowly extended extremity of carapace, and before it dorsally a strong transverse impression. **M. rectangularis** sp. nov.

MALES

a^1. Prestigma stramineous; genital aperture semicircular.
  b^1. Abdomen basally broadly yellow; radial cell infuscate; length, 5.5 millimeters........ **M. bidentatus sp. nov.**
  b^2. Abdomen black; radial cell hyaline; length, 6 millimeters. **M. megacephalus sp. nov.**
a^2. Prestigma piceous; genital aperture circular; abdomen black; length, 4 to 4.25 millimeters........ **M. consociatus sp. nov.**

Megachelonus areolellus sp. nov.

Length, female, 5 millimeters.

Female.—Black; abdomen with entire basal third yellowish; scape, annellus, and most of first flagellar joint yellowish; remainder of flagellum dark ferruginous. Mandibles yellowish. Hind legs piceous, apices of coxæ, trochanters, extreme bases of femora, and tarsi dark yellowish; middle and fore legs dark yellowish throughout. Wings hyaline with region of radial cell somewhat infumated; prestigma, costa, and basal and median veins yellowish, remaining veins dark but none so dark as stigma; tegulæ yellowish.

Clypeus closely, finely punctured basally, apically more coarsely and sparsely, the middle third of anterior margin slightly, roundly extended. Face finely, densely, uniformly rugosopunctate, with a very short, smooth median carina at base. Scrobes sharp-margined below and between antennæ, divided medially by an obtuse longitudinal ridge, the basins longitudinally wrinkled at extreme sides, within and above minutely, shallowly foveolate, and rather strongly narrowed above. Genæ densely, obliquely wrinkled. Vertex transversely wrinkled, becoming foveolate in the ocellocular area. Posterior ocelli widely separated, the distance between their outer margins being equal to the ocellocular distance. Notauli extending to base, marked by a row of large foveolæ larger at base, between these with two longitudinal rows of large foveolæ on either side of a rough but strong median carina which with its flanking foveolæ is percurrent. Lateral basal areas of mesonotum punctate, submedian anterior areas weakly transversely rugose. Scutellum basally sexfoveate, centrally smooth and shining, minutely but very sparsely punctate. Propodeum with a very strongly marked deeply sexfoveate median subtriangular area, its apical margin deeply depressed and emarginate, its lateral apical angles projecting over posterior face as two very stout protuberant teeth; posterior lateral angles of propodeum only slightly prominent, the posterior concave face strongly foveolate. Pleuræ entirely very coarsely foveolate. Abdomen about as long as head and thorax together, from above of usual chelonoid form, but laterally appearing very deep and strongly rounded apically, giving a very strongly and obtusely clavate appearance in the lateral view;[5] the ventral cavity very short, falling far short of reaching apex, and therefore without apical teeth; tergum with humeral carinæ slightly oblique, between these four strong smooth costulæ; beyond base of yellow portion of tergum the surface is covered with very numerous, small, equal-sided foveolæ without any sign of longitudinal trend; farther caudad these become larger, more irregular, shallower, and have very fine secondary foveolations within. Antennæ 16-jointed, distinctly broadened on third fourth, then rapidly tapering to the apices; scape about as long as first flagellar joint, the annellus about one-fourth as long. First abscissa of radius distinctly longer than second, the latter subequal to second transverse cubitus. Nervulus very shortly postfurcal.

Penang (*Baker*).

Megachelonus bidentatus sp. nov.

Length, female, 5.75 millimeters; male, 5.5.

Female.—Black; abdomen with entire basal third yellowish; scape, annellus, and most of first flagellar joint dark yellowish; remainder of flagellum dark ferruginous. Mandibles dark ferruginous, black at base. Legs dark yellowish; apical two-thirds of hind femora, and hind tarsi piceous, the base of femora paler yellowish; middle tibiæ obscurely darkened apically. Wings hyaline with region of radial cell somewhat infumated; prestigma and basal and median veins pale, costa and remaining veins dark, the radius as dark as stigma. Tegulæ pale, yellowish. The male differs not at all in coloration except that the costal margin of wing is pale, and the middle tibiæ are not at all darkened.

Clypeus smooth and shining, minutely, very sparsely punctate, the anterior margin truncate. Face with a strong percurrent median carina, the surface with large, very shallow foveolæ, these minutely rugose within, and stronger and deeper just before clypeus. Scrobes sharp-margined at sides and below and completely separated by the high sharp percurrent continuation of the facial carina, basins within smooth and shining; two strong longitudinal rugæ between scrobes and orbits. Genæ shallowly large foveolate but with very blunt rugæ next eye, outer half very shallowly and indistinctly obliquely rugose, the occipital margin distinctly reflexed. Vertex distinctly concave, laterally coarsely longitudinally rugose, surface all minutely roughened; ocellocular distance distinctly greater than over-all width of ocellar area. Pile on mesonotum very thick and strong, obscuring the sculpturation. Notauli marked on basal half by deep foveæ, deeper basally; at base outside notauli two longitudinal rows of foveæ; between notauli two longitudinal rows of foveæ flanking a percurrent, blunt, and irregular median carina; the lateral basal areæ and the anterior submedium areæ with shallow foveolæ separated by very blunt rugæ, the rims of which are sparsely punctured. Scutellum quinquefoveate basally, centrally very roughly though obscurely rugose and punctured. Median area of propodeum deeply bifoveate at base, multifoveate apically, the apical angles of this area strongly protuberant as are the lateral angles, remainder of upper surface foveolate; posterior face with very deep rounded foveolæ, these being smaller and somewhat separated at middle.

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[5] More so than in any Malayan *Chelonus* known to me.

Abdomen shorter than head and thorax together, sides (seen from above) quite straight, as seen from side of the same depth throughout (except extreme base); humeral carinæ of tergum oblique and with about seven strong costulæ between them; all the basal costulæ percurrent through middle third of tergum with numerous irregular foveolæ between them, breaking up into much finer sculpturation toward the densely white silky apical declivity. Ventral cavity narrowly cut through to very apex of abdomen, here its lateral angles protuberant in two small blunt teeth directed straight caudad. Antennæ as in *M. areolellus* except that almost entire apical half is distinctly broadened and flattened.

The male differs in having only one very strongly raised ruga between scrobe and orbit. The abdomen is of similar form, but the ventral cavity does not nearly reach the apex. Instead, there is a large apical aperture which is transversely semicircular and bordered by minute hairs all directed inward; just before this aperture the abdomen is deeper than it is basally. Antennæ broken, but evidently with joints much more numerous than in female, and more teretely filamentous. First and second abscissæ of radius subequal, the second transverse cubital a little shorter. Nervulus postfurcal to one-fourth of the first abscissa of discoidal.

Singapore (*Baker*).

Megachelonus megacephalus sp. nov.

Length, male, 6 millimeters.

Male.—Black, without yellow on abdomen, either above or below. Antennæ basally very dark ferruginous, becoming piceous apically. Mandibles very dark ferruginous; legs pale ferruginous; apical two-thirds of hind femora and all hind tarsi piceous. Wings hyaline; prestigma, costa, and basal and median veins pale yellowish; remaining veins progressively darker but none so dark as stigma. Tegulæ ferruginous.

Clypeus smooth and shining, very sparsely punctate, the anterior margin broadly arcuate. Face with median carina indistinct apically, basally strongly, sharply raised, and percurrent between scrobes; surface of face transversely (at sides obliquely) coarsely, shallowly, irregularly rugose. Scrobes sharp-margined at sides and below, smooth and shining within, several longitudinal rugæ between scrobes and orbits. Genæ with several strong irregular rugæ near eye, remainder of surface very indistinctly rugose. Vertex not concave, coarsely, shallowly, confusedly rugose with some small punctures; total width of ocellar area about equal to ocellocular width. Sculpturation of thorax and abdomen very similar to that of *M. bidentatus;* triangular area of propodeum deeply depressed and very broad apically. Form of abdomen very similar to that of *M. bidentatus* except that, as viewed from side, there is a slight extension of the apex below the aperture. Apical aperture as in *M. bidentatus.* First abscissa of radius distinctly longer than second, the latter a little longer than second transverse cubital. Nervulus postfurcal to one-fourth first abscissa of discoidal.

Surigao, northeastern Mindanao (*Baker*).

This is the largest species of the genus.

Megachelonus consociatus sp. nov.

Length, male, 4 to 4.25 millimeters.

Black, without yellow on abdomen, either above or below. Antennæ with scape, annellus, and flagellum basally beneath pale ferruginous, remainder very dark ferruginous. Legs pale ferruginous, apical halves of hind tibiæ, and hind tarsi piceous. Wings hyaline, the median veins stramineous, remainder, including basal, dark, the stigma and prestigma very dark. Tegulæ ferruginous.

Clypeus rather closely, coarsely punctured, anterior margin broadly arcuate; face with large, deep foveolæ separated by high sharp rugæ, larger and more irregular near clypeus; the upper showing a tendency to transverse arrangement; no indication of median carina. Scrobes separated by a high and strong carina, highest between antennæ, the entire inner surface of scrobes coarsely foveolate; one high, strong, longitudinal ruga between scrobes and orbit. Vertex with very strong pentangular and sexangular foveolæ, the entire width of ocellar area subequal to the ocellocular width. Genæ entirely very coarsely foveolated, the foveolæ near eye longitudinally arranged. Entire mesonotum coarsely foveolate, those on median basal area very strong and deep and arranged in four longitudinal rows, those elsewhere shallower and more irregular. Scutellum basally quinquefoveate, the middle area occupied by about six large foveæ. Propodeum very short at middle, the median area high-rimmed, deeply depressed, very broad apically and within with but two transverse rows of very large foveæ, two basal and five apical; except for the broad, deep emargination of the medium area, the hind margin of upper and lateral faces broadly, laminately expanded caudad and with laminate teeth bounding median area and at lateral angles; the deeply excavated posterior face thickly covered with subcircular foveolæ. Abdomen narrowly subelliptical in outline, gradually narrowed to a subacute apex, this appearance produced by a slight extension below the apical aperture; viewed from the side the abdomen is somewhat deeper apically than basally. Ventral cavity falling far short of reaching apex. Apical aperture subcircular. Antennæ 25-jointed, the flagellum evenly, teretely filamentous, acute at tips. First abscissa of radius distinctly longer than second and the latter subequal to second transverse cubital. Nervulus shortly postfurcal.

Singapore (*Baker*).

During the days when this species was taken, males were common on the wing, but not a female was seen. A great excess of males is a rare occurrence in this subfamily.

Megachelonus uniformis sp. nov.

Length, female, 3.5 millimeters.

Female.—Black, abdomen without yellow; scape and annellus pale ferruginous, flagellum very dark ferruginous. Legs yellowish, hind tarsi piceous. Wing hyaline, veins pale stramineous, the costa, prestigma, stigma, and radial vein clear brown. Tegulæ stramineous.

Clypeus with separated coarse punctures, the anterior margin broadly arcuate. Face coarsely, irregularly, deeply foveolate throughout but with a distinct percurrent median carina, this carina continued to separate the scrobes, very high below and between antennæ, low above. Scrobes smooth and shining within, some irregular foveolæ next median carina, sharp-rimmed below and with one high, sharp, longitudinal ruga between scrobe and orbit. Genæ obliquely rugose punctate. Vertex a little concave, very short, the occipital slope beginning just behind lateral ocelli, small foveolate throughout, over-all ocellar width subequal to ocellocular distance. Thoracic sculpturation as in *M. bidentatus,* except that scutellum is centrally irregularly foveolate; lateral teeth of propodeum far larger and more strongly protuberant than the submedian. Tergum with humeral carinæ hardly distinguishable except at extreme base, the surface with numerous longitudinal percurrent (on basal half) costulæ, the foveolæ between them having a tendency to be quadrangular on basal half, apically the costulæ and much smaller foveolæ are very irregular. Abdomen, viewed from side, of uniform depth throughout, ventral concavity narrowly continued to apex where its bounding angles are protuberantly, porrectly toothed. Antennæ 16-jointed, apical third distinctly flattened and broadened. Nervulus very shortly postfurcal; first abscissa of radius distinctly longer than second abscissa or second transverse cubitus, the latter two subequal, the last not decolored.

Los Baños, Luzon (*Baker*).

This is the smallest species of the genus. A fully colored, second transverse cubital nervure is very unusual in this subfamily.

Megachelonus bicoloricornis sp. nov.

Length, female, 4 millimeters.

Female.—Black, abdomen without yellow markings. Scape and basal half of flagellum pale ferruginous, apical half piceous. Legs pale ferruginous; hind coxæ except apices and apical third of hind tibiæ piceous. Wings hyaline, costa and basal and median veins very pale, remaining veins and stigma much darker. Tegulæ stramineous.

Clypeus with coarse, separated punctures and with a few short, oblique rugæ at extreme sides. Face coarsely foveolate and with many punctures, the foveolæ large, shallow anteriorly, much deeper on upper half of face where the high strong separating rugæ become markedly transverse; rugæ also form an irregular but strong median carina. Scrobes separated by a low median carina and very broadly extended to the high sharp ruga near orbits (this ruga reaching lateral ocellus), the inner surface smooth and shining, largely occupied by separated, rounded foveæ of varying sizes. Genæ and vertex coarsely foveolate. Mesonotum strongly grayish because of appressed pubescence which obscures the sculpturation. Notauli deeply foveolate to half length of mesonotum, the foveolæ being coalescent; between bases of notauli with two short longitudinal rows of large, partially coalescent foveolæ; anterior median area thickly punctate and with two distinct, shallow, longitudinal depressions, a small latero-basal area punctate, remainder shallowly small foveolate. Scutellum quinquefoveolate at base, the three median basal foveæ extended as deep, sharp-rimmed channels, posteriorly across median area. Propodeum very coarsely foveate, the median area deeply depressed and very broad apically, its posterolateral angles and lateral angles of propodeum dentately produced. Mesopleuræ entirely occupied by very large and deep, mostly regularly sexangular foveæ. Abdomen about as long as head and thorax together. Dorsum with humeral carinæ not distinguishable from the many, very strong, straight costulæ, their rims thick and occasionally punctate, and extending to two-thirds length of carapace. Ventral cavity, by a narrow channel, open to apex, there flanked by two short porrect teeth. Antennæ 16-jointed, the flagellum distinctly flattened and broadened on apical half. First abscissa of radius subequal to second, the second transverse cubital distinctly shorter and not decolored. Nervulus very shortly postfurcal.

Tangkulan, Bukidnon Province, Mindanao (*Baker*).

Megachelonus rectangularis sp. nov.

Length, female, 5.5 millimeters.

Female.—Black; abdomen without yellow markings. Scape and annellus pale ferruginous, flagellum piceous. Legs pale ferruginous, anterior paler, hind coxæ and tibiæ somewhat darker, hind tarsi piceous. Wings hyaline, all veins very pale except costa, radius, and second abscissa of cubitus which are pale brown like the stigma. Tegulæ pale ferruginous.

Clypeus rather thickly coarsely punctate, somewhat rugose at extreme sides, and with anterior margin rather narrowly rounded. Face coarsely, deeply, transversely (at the sides obliquely) rugose and medially foveolate, without a median carina. Scrobes separated by a low median carina, the inner surface smooth and shining, obscurely tranversely wrinkled; between scrobes and orbits, three strong rugæ. Genæ obliquely rugose-punctate, punctures thicker near orbit. Vertex somewhat longitudinally rugose-foveolate. Notauli marked by large deep foveolæ; whole mesonotum elsewhere with smaller irregular foveolæ of varying sizes. Scutellum basally with six large somewhat irregular foveæ, the median area bordered all around by deep foveolæ, the disk coarsely punctured and very small foveolate. Propodeum very coarsely, deeply foveolate, the median area of the narrower type, sexfoveolate, not very wide or deeply depressed apically; apical angles very obtusely dentate, as are also lateral angles of propodeum. Pleuræ entirely coarsely foveolate. Dorsum of carapace with numerous costulæ at base, but these soon broken up, forming a great number of elongate, compound foveolæ; the depression before the distinctly extended apex is longitudinally rugose. The apical opening of ventral cavity is carried well on to the dorsal surface of the extended apex where it is preceded by a strong transverse impression; the ovipositor is straightly, correctly exserted from this opening; the sides of the apical opening below, at apices of sides of ventral cavity, are thickly, shortly, dentately extended, but the teeth are thus lateral and not submedial as in other species. Antennæ 19-jointed (broken in the type), the flagellum evidently but very slightly enlarged apically. First abscissa of radius slightly longer than second, the latter distinctly longer than second transverse cubital. Nervulus postfurcal to one-third of first abscissa of discoidal.

Mount Banahao, Laguna Province, Luzon (*Baker*).

This species presents an extreme development of the genital opening that is not duplicated in any other chelonid known to me. It is also very distinct in its other characters.

Genus **ASCOGASTER** Wesmael

This genus is composed largely of species which closely resemble *Chelonus* of the various groups of that genus, differing most strikingly in the presence of the first abscissa of cubitus; but, in addition, it includes some species of quite distinct structure. It apparently is not a natural group, even as here delimited, and rapidly accumulating material will necessitate a recast of the whole complex at some early date.

The Australian species, so far as known, differ from the Malayan very strikingly, in having the sculpture of head and thorax tending toward simple puncturation instead of foveolation or rugose puncturation. The appendages in the Australian species are also commonly darker than in the Malayan species; but they apparently differ most widely in the antennal scrobes, which usually present simple depressed surfaces sculptured like the vertex, instead of the delimited and differently sculptured cavities of the Malayan species.

Szepligeti[6] described five Australian (New South Wales) and one Papuan species, synopsizing them entirely on color characters, and presenting very incomplete descriptions. I have included these in the following synopsis on such characters as were given, even though it weakens the synopsis to do so. Fullaway[7] described two Javan species; his descriptions are much longer than those of Szepligeti, but are still more difficult to use, since the majority of the characters described are those of the genus, tribe, or subfamily, and therefore the specific position is uncertain.

Synopsis of species of Ascogaster Wesmael.

a^1. Antennal scrobes distinctly delimited by carinate rims, the interior sculpturation different from the exterior, mesonotum largely, strongly foveolate; vertex usually foveolate like the mesonotum; venation pale. Malayan species.
  b^1. Nervulus shortly postfurcal, first abscissa of radius as long as or very little longer than second; usually very small species of short, compact form.
    c^1. Abdomen with more or less yellow at base; a small smoky cloud below the dark stigma.
      d^1. Yellow of tergum bright and clear, occupying a large part of basal third; clypeus coarsely punctate throughout; male, length, 2.75 millimeters .... **A. inconspicuus** sp. nov.
      d^2. Yellow of tergum an obscure transverse mark at extreme base, clypeus with large median basal area impunctate; male, length, 2.75 millimeters .... **A. luzonensis** sp. nov.
    c^2. Abdomen black (male); notauli marked by broad lines of foveæ; male, length, 5 millimeters .... **A. argentea** Fullaway.[8]

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[6] Ann. Mus. Nat. Hung. **3** (1905) 36.

[7] Journ. Straits Asiat. Soc. **80** (1919) 49.

[8] Position doubtful.

b^2. Nervulus long postfurcal; first abscissa of radius considerably longer than second; head seen from above with genæ very broad behind eyes.

c^1. Stigma pale, no smoky cloud beneath it, veins all pale; sculpturation of head and thorax predominantly foveolation and rugose puncturation; male, length, 4 millimeters...... **A. longulus** sp. nov.

c^2. Stigma dark, with a fuscous cloud beneath it; veins dark; sculpturation of head and thorax predominantly coarse simple puncturation; male, length, 4 to 4.5 millimeters; female, 5 millimeters. **A. philippinensis** sp. nov.

a^2. Antennal scrobes not delimited by carinate rims, interior sculpturation, at least above, same as that of adjoining surface; mesonotum largely punctate; venation usually very dark. Australian and Papuan species.

b^1. Head black.

c^1. Hind femora ferruginous.

d^1. Head transverse, strongly narrowing behind eyes as seen from above.

e^1. Small species, length, 3.25 to 3.5 millimeters.

f^1. Notauli wanting; mesonotum, mesopleuræ, and dorsum rugose; clypeus (male) nearly straight-edged anteriorly and with a median tooth; male, length, 3.25 millimeters. **A. australiensis** Szepligeti.

f^2. Notauli distinguishable; mesonotum rugose at middle; mesopleuræ punctured; dorsum "coriaceo-rugose;" clypeus (male) arcuate-edged anteriorly; male, length, 3.5 millimeters...... **A. tegularis** Szepligeti.

e^2. Very large species; female, length, 5 millimeters; abdomen "alutaceous."...... **A. erythropus** Cameron.[9]

d^2. Head subcubical as seen from above, with genal margins long, and throughout (to occiput) as wide as across eyes; tegulæ, scapes, palpi, and abdomen black; male, length, 4.5 millimeters. **A. intensus** sp. nov.

c^2. Hind femora black or piceous; head rugose-punctate or "coriaceous;" clypeus with an evenly arcuate anterior margin.

d^1. Tegulæ and palpi black; head transverse, "coriaceous," the face thickly punctate; antennæ (male) 27-jointed; mesonotum punctate, rugose at middle; mesopleuræ shining on disk; dorsum "coriaceous;" male, length, 4 millimeters. **A. palpalis** Szepligeti.

d^2. Tegulæ and palpi ferruginous to pale yellowish; head rugose-punctate.

e^1. Wings largely hyaline, beneath stigma an indistinct fuscous cloud.

f^1. Dorsum sculptured throughout; male, length, 3.5 millimeters. **A. modestus** sp. nov.

f^2. Dorsum with nearly apical third smooth and shining; female, length, 2.5 millimeters...... **A. laeviventris** sp. nov.

[9] Position doubtful.

e^2. Wings largely infuscated, usually more deeply so in region of radial cell and beneath stigma.

f^1. Wing with a narrow conspicuous transverse white band crossing from prestigma; length, female, 3 millimeters. **A. cinctus** sp. nov.

f^2. Wing without transverse white band.

g^1. Notauli distinct; abdomen (male) yellow at base; antennæ (male) 26-jointed; mesonotum thickly, finely punctate; mesopleuræ shining; beneath stigma a dark spot; male, length, 2 millimeters............ **A. novoguineensis** Szepligeti.

g^2. Notauli indistinct; abdomen (female) black; antennæ (female) 19-jointed; mesonotum rugose; mesopleuræ punctate; apical margin of dorsum (female) emarginate; ovipositor as long as abdomen and propodeum together; basal vein yellowish; female, length, 4 millimeters.. **A. caudata** Szepligeti.

b^2. Head entirely or largely bright ferruginous.

c^1. Apex of abdomen entirely smooth and shining; basal half of male dorsum yellow.

d^1. Vertex thickly finely punctate; hind tibiæ nearly all black; male, length, 3.5 millimeters.................................. **A. tricolor** Szepligeti.

d^2. Vertex transversely rugose, with few weak punctures; hind tibiæ all yellowish; male, length, 2.5 millimeters. **A. detectus** sp. nov.

c^2. Apex of abdomen sculptured throughout.

d^1. Head entirely ferruginous; vertex transverse rugulose-punctate.

e^1. Hind legs largely piceous; wings rather strongly infumated and with a conspicuous, narrow, hyaline transverse band extending from between prestigma and stigma, which does not involve the veins traversed; first abscissa of radius much longer than second transverse cubital nervure; scutellum smooth and shining with very sparse minute punctures; mesonotum basally without median carina; abdomen black; male, length, 3 millimeters............ **A. vividus** sp. nov.

e^2. Hind legs pale yellowish like others; wings less infumated and hyaline crossband inconspicuous; first abscissa of radius subequal to second transverse cubital.

f^1. Scutellum smooth and shining, with very sparse punctures; mesonotum basally without median carina; abdomen with basal third suffused and very dark ferruginous, this very inconspicuous; ? female, length, 3.25 millimeters. **A. vividus** sp. nov.

f^2. Scutellum very coarsely punctured; mesonotum basally with a strong sharp median carina; abdomen with basal third clear stramineous; female, length, 3 millimeters. **A. distinctus** sp. nov.

d^2. Head with the vertex largely black, coarsely punctured, the transverse rugæ very strong; abdomen black; legs yellowish throughout, hind tibiæ whitish basally; male, length, 3.5 millimeters.. **A. maculaticeps** sp. nov.

Ascogaster inconspicuus sp. nov.

Length, male, 2.75 millimeters.

Black; abdomen with a large yellow spot on basal third of dorsum, extending from and including whole width of base, but somewhat roundly narrowed apically. Scapes pale ferruginous; flagella piceous. Legs stramineous, hind coxæ stramineous, darker basally; apical third of hind femora, apical half and extreme base of hind tibiæ, and base of hind tarsi piceous. Wings hyaline, the veins pale brown, costa and stigma darker, basal vein and first abscissa of cubitus paler. Tegulæ dark ferruginous.

Clypeus very coarsely punctate, apically narrowly arcuate. Face very coarsely rugose, the rugosities in large part very strongly oblique—downward and mesad; a strong median carina percurrent to near clypeus, the surface on either side of this basally depressed, more broadly so at extreme base and this area transversely rugose. Lower rims of antennal sockets raised anteriorly into blunt dentate protuberances. Malar space long, about equal to width of eye. Genæ very coarsely longitudinally rugose. Vertex and temples very coarsely, deeply foveolate. Entire mesonotum very strongly deeply foveolate, the foveolæ small on anteromedian area, the notauli not distinguishable. Scutellum very coarsely quadrifoveate at base, median area coarsely rugose. Propodeum covered with very large, deep foveæ, the posterior rim with very strong blunt teeth submedially and laterally. Pleuræ strongly deeply foveolate. Dorsum very coarsely longitudinally foveolate, the larger foveolæ with numerous smaller foveolæ within. Viewed from side the abdomen is about as long as thorax, very gradually deeper apically where it is broadly rounded; ventral cavity reaching nearly to apex. Antennæ 35-jointed and about as long as body, the flagella rather stout, strongly tapering on apical fourth. First abscissa of radius slightly longer than second, the latter about equaling the nondecolored second transverse cubital; nervulus postfurcal to one-fourth length of first abscissa of discoidal. Third abscissa of radius nearly straight.

Cuernos Mountains, Oriental Negros (*Baker*).

Ascogaster luzonensis sp. nov.

At Los Baños, in central Luzon, we found a small species of the same size, same number of antennal joints, and similar type of sculpturation which, however, differs in so many details that it cannot even be considered as a variety of the Negros form (*inconspicuus*).

Male.—Yellow marking of abdomen reduced to an obscure transverse mark at extreme base. Hind coxæ very dark ferruginous at base, hind tibiæ and tarsi except basally pale piceous. Wings with stigma and veins all equally pale brownish, the costa darker, second transverse cubitus not decolored. Clypeus with large median basal area smooth and shining, impunctate. Facial rugæ much stronger and fewer than in the preceding species. Vertex and mesonotum equally very strongly foveolate. Submedian teeth of posterior rim of propodeum more strongly protuberant. Tergal foveolæ deeper, narrower, more strongly longitudinal and with fewer interior smaller foveolæ. Nervulus very shortly postfurcal.

Ascogaster longulus sp. nov.

Length, male, 4 millimeters.

Black; abdomen with a small irregular median yellow spot near base, the venter more extensively yellowish. Scape pale yellowish, flagellum very dark ferruginous. Legs pale yellowish, the hind tibiæ on apical half and extreme base and the hind tarsi piceous. Mandibles ferruginous, darker at tips. Wings hyaline, stigma and veins pale brownish, second transverse cubital decolored. Tegulæ pale yellowish.

Clypeus roughly, thickly, irregularly punctured, anterior margin medially very broadly rounded. Face very roughly, coarsely, irregularly rugose-foveolate; with a strong but rough, percurrent median carina; parallel to this and to orbits and continued straight apicad from sockets, occur two prominent longitudinal rugæ, not, however, quite as strong as median carina; between these lateral rugæ and the orbits the surface is somewhat concave and weakly but coarsely transversely rugose. Scrobes narrow and sharp-margined, one strong longitudinal ruga between margin and orbit. Genæ thick, set with deep rounded foveolæ, the foveolæ of vertex larger and more angular. Notauli occupied by very large and broad foveæ, between their bases two short longitudinal rows of very large foveæ; remainder of mesonotum covered with smaller rounded foveolæ, those on anterior median area and lateral basal area very small. Scutellum quinquefoveate at base, median area coarsely longitudinally rugose-punctate. Propodeum very coarsely foveolate throughout, the median area strongly broadened apically where its sides are very strongly obtusely dentate, as are also lateral angles of rim. Mesopleuræ thickly, coarsely, rather roundly foveolate. Tergum with the short basal costulæ soon broken up into shallow foveolæ of irregular sizes and shapes and without longitudinal trend. Viewed from side, the abdomen is very gradually deeper to the broadly rounded apex, and not as long as thorax and head together. Antennæ 28-jointed and somewhat longer than entire body, flagella slightly enlarged on apical halves, the tips somewhat attenuate. First abscissa of radius distinctly longer than second, the latter subequal to second transverse cubital. Nervulus shortly postfurcal. Third abscissa of radius distinctly arcuate.

Mount Maquiling, central Luzon (*Baker*).

Ascogaster philippinensis sp. nov.

Length, male, 4 to 4.25 millimeters.

Black; tergum with a clear pale yellowish mark extending from entire breadth of base, long triangularly, to two-fifths the length; remainder of tergum may have a very dark ferruginous cast. Scape pale yellowish below, ferruginous above, flagellum piceous. Legs pale yellowish, fore tibiæ a little darker, pale piceous are middle tibiæ (except basal annulus) and tarsi, darker piceous on upper surface of hind coxæ and femora, and hind tibiæ and tarsi except a white annulus near base of tibiæ. Stigma and veins dark brownish, second transverse cubitus decolored; a narrow infuscation extending from stigma through second cubital cell. Tegulæ dark ferruginous.

Clypeus sparsely coarsely punctate. Face thickly and coarsely but smoothly and deeply punctate, with high, thin median carina on basal half, highest between antennæ and percurrent between scrobes; just above antennal insertions there are several short longitudinal rugæ between rims of scrobes and orbits. Head subcubical, the vertex long extended behind eyes, this extension greater than the over-all ocellar width; surface coarsely, rather closely punctate. Genæ smooth and shining, sparsely, coarsely punctate. Mesonotum without vestige of notauli, a few irregular roundish foveolæ at basal middle, the entire remaining area with very large deep punctures, not very thickly distributed over the shining surface. Scutellum septemfoveate at base, the median surface coarsely punctate and with some smooth indistinct longitudinal rugæ. Propodeum with large, deep, angular foveæ throughout, the median area not demarked, the posterior rim very weak, submedian teeth lacking, lateral teeth short and blunt; posterior face sculptured like superior. Tergum on basal third with numerous weak longitudinal costulæ, on median third with very numerous, elongate, shallow foveæ of irregular form, each with smaller foveolæ within, the larger rims low, thick, and shining; terminal third densely, longitudinally rugose-punctate. Abdomen not quite as long as head and thorax together, viewed from side becoming gradually deeper apically, the apex broadly rounded. Disk of mesopleura covered with round foveolæ of varying sizes. First abscissa of radius considerably longer than second, this subequal to second transverse cubital; third abscissa somewhat arcuate. Nervulus postfurcal to one-third of first abscissa of discoidal. Antennæ 45-jointed, extending beyond abdomen a distance about three-fourths length of abdomen.

Mount Maquiling, central Luzon (*Baker*). Also taken on Mount Banahao.

A larger (length, 5 millimeters), heavier-bodied female from Butuan, Mindanao, must be referred to this species. It has the basal yellow mark of tergum more shortly triangular, and a large round spot on extreme apex of abdomen is somewhat yellowish—though the latter may represent mere aberration. Otherwise the details of structure are very closely similar. The antennæ of this Butuan specimen are unfortunately broken.

This is the only Malayan representative of the Australian group in which the sculpturation is largely coarse punctuation. It, however, possesses the characteristic scrobes and other features of the Malayan species.

Ascogaster intensus sp. nov.

Length, male, 4.5 millimeters.

Black; antennæ black throughout, the scape shining, intense black; palpi black. Mandibles nearly black. All coxæ black, and all tarsi piceous; middle femora and tibiæ and hind tibiæ ferruginous, hind femora strongly reddish. Wings slightly smoky basally, more deeply so apically. Stigma and veins very dark, only the median vein basally paler. Second transverse cubital decolored. Tegulæ black.

Clypeus on median area thickly, coarsely punctate, at sides rugose-punctate, the anterior margin narrowly truncate. Face very short, its breadth about one and a half times the length (antennal sockets to clypeal suture), densely coarse punctate only on a small middle area, otherwise densely rugose-punctate. Scape very short, not reaching median ocellus. Scrobal depression not laterally delimited, and rugose-punctate same as the wide vertex; genæ behind eyes very full and long, as seen from above the head, as wide across base of genæ as across eyes; ocellocular distance much greater than total width of ocellar area. Mesonotum small foveolate on depressed basal area with larger transverse foveæ along lines of notauli, the entire remaining surface thickly, coarsely punctate. Scutellum sexfoveate basally, the entire disk coarsely punctate. Propodeum with superior face very short, irregularly foveate, the moderately deep foveolæ of various sizes and shapes, the median area indistinctly outlined, the posterior rim weak and without submedian or lateral teeth, the posterior face strongly oblique and not deeply concave. Dorsum with short, strong humeral carinæ but without longitudinal costulæ between, the entire surface densely, very evenly, minutely foveolate, without any longitudinal trend, this uniform to the extreme apex; the apex with a short, projecting, thick, vertical, sublamellate keel. Abdomen, viewed from side, as long as head and thorax together, thin basally, deepening rapidly on apical half to the broadly rounded apex. Mesopleura largely covered by small, round, separated foveolæ. First abscissa of radius distinctly longer than second, the latter subequal to second transverse cubitus; third abscissa of radius rather strongly upcurved. Nervulus postfurcal to one-third of first abscissa of discoidal. Antennæ reaching to middle of abdomen, 27-jointed.

Illawarra, New South Wales (*H. Petersen*).

Evidently related to *A. palpalis* Szepligeti, but that species has black hind femora.

Ascogaster modestus sp. nov.

Length, female, 3.5 millimeters.

Black; abdomen with basal third pale yellowish, this angularly extended on median line. Scape, annellus, and first joint of flagellum bright ferruginous, remainder of flagellum piceous. Legs stramineous, hind coxæ and femora black; fore and middle femora, apical third of hind tibiæ, and hind tarsi more or less distinctly piceous. Mandibles ferruginous, palpi stramineous, wings hyaline, a slight fuscous tinge below stigma; stigma and most of veins very dark, basal and median veins testaceous, second transverse cubitus decolored. Tegulæ testaceous.

Clypeus with most of surface shining, coarsely but very sparsely punctate, more densely and rugosely punctate at extreme sides, the anterior margin narrowly subtruncate at middle. Face densely, coarsely punctate, somewhat rugosely so toward malar spaces; straight longitudinal impressions occur submedially. Scrobes coalescent, not specially delimited, and with the interior sculpturation rugose-puncturation like that of vertex. Over-all ocellar width much less than ocellocular distance. Head very short behind eyes, the genæ rapidly narrowed to occiput; length of malar space nearly equal to width of eye; genæ rather sparsely coarse punctate. Mesonotum with large impressed basal area thickly and irregularly, very small foveolate, some foveolæ extending along lines of the scarcely impressed notauli; remainder of surface thickly coarse punctate. Scutellum basally sexfoveate, the disk sparsely coarse punctate. Mesopleura in large part sparsely coarse punctate. Propodeum covered with rounded foveolæ of varying size on upper face, the median area sharply outlined, with about eight foveolæ within, nearly rectangular in outline and not reaching base; posterior rim without submedian teeth and the lateral angles very obtuse; posterior face nearly vertical, and strongly sculptured. Dorsum with short, strong, oblique humeral carinæ, but without indication of longitudinal costulæ otherwise; entire surface deeply, sharply, minutely foveolate, the foveolæ mostly somewhat elongate; this sculpturation becomes a coarse rugose-puncturation on extreme apex. Abdomen scarcely as long as head and thorax together, viewed from side very gradually deepening to the not strongly rounded apex; the ventral concavity extends to apex, and here the ovipositor (in this specimen) is exserted to more than half the length of abdomen, the hypopygium extended considerably beyond apex. The second joint of maxillary palpi is strongly, subangularly dilated at middle. Antennæ 25-jointed, the scape rather strongly swollen at middle and reaching lateral ocelli; the flagellum much stouter on apical half, then suddenly attenuate to apex. First abscissa of radius but slightly longer than second, second subequal to second transverse cubitus; third abscissa slightly upcurved. Nervulus postfurcal to one-fourth first abscissa of discoidal.

Botany Bay, New South Wales (*Petersen*).

This species has the appearance of an ordinary small *Chelonus,* but is very distinct in the details of structure.

Ascogaster laeviventris sp. nov.

Length, female, 2.5 millimeters.

Black, with very scant pubescence. Antennæ piceous, the scape, annellus, and first joint of flagellum dark ferruginous beneath. Legs sordid stramineous, all the femora except more or less at apex and base of each, and hind coxæ piceous; middle tibiæ darker apically; hind tibiæ and tarsi piceous. Wings hyaline, slightly infumated beneath stigma, the veins nearly concolorous, paler than stigma, second transverse cubitus decolored. Tegulæ sordid stramineous.

Clypeus with sparse, coarse punctures, its anterior border somewhat extended and reflexed, also narrowly arcuate. Face coarsely rugose-punctate, the trend of rugæ being downward and mesad; basal half with a distinct median ridge, but this not continued between antennæ; the face much wider between orbits than long from antennal sockets to clypeus. Vertex and scrobal depression uniformly transversely rugose-punctate, without longitudinal rugæ next orbit. Vertex not at all concave, the ocellocular distance but slightly more than ocellar width. Scapes rather short and thick, not reaching lateral ocelli. Mesonotum with entire basal depressed area occupied by small, crowded areolæ, which are shortly extended along lines of notauli, the remainder of surface covered with very large adjoining punctures. Scutellum sexfoveate at base, median area sparsely punctured. Mesopleuræ sparsely punctate, hind border margined with a single row of very uniform foveolæ.

Propodeum reticulate-foveate, the narrow median area with strongly raised margins; submedian and lateral dentations very obtuse, hardly evident. Dorsum with the two short oblique humeral carinæ strong, the entire remainder of surface of basal two-thirds covered by fine, crowded, longitudinal reticulating rugosities, these obsolescent on apical third which is smooth and shining.[10] Viewed from side, abdomen much shorter than head and thorax, becoming very gradually deeper apically, the ventral concavity broadly extended to apex, where the ovipositor projects about one-fourth length of abdomen. Antennæ broken beyond fourteenth joint, but thus far stoutly terete. First and second abscissæ of radius and second transverse cubitus subequal in length; third abscissa of radius straight. Nervulus postfurcal to a little more than one-fourth length of first abscissa of discoidal.

Botany Bay, New South Wales (*Petersen*).

One specimen of this unique species. One of the most distinct of many new forms discovered by Mr. Petersen.

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[10] A condition not noted elsewhere in this tribe in such extreme development.

Ascogaster cinctus sp. nov.

Length, female, 3 millimeters.

Black; basal third of abdomen stramineous, the hind margin of this colored area transversely straight. Basal half of antennæ ferruginous, apically piceous. Legs stramineous; all femora and hind coxæ largely piceous, as well as hind tibiæ except at base and hind tarsi. Wings palely infuscated, more deeply so beneath the stigma, veins mostly as dark as stigma; proximal point of stigma bright stramineous and from this a narrow white band extends across the wing to outside the second abscissa of discoidal nervure. Tegulæ stramineous.

Clypeus smooth and shining, with few widely separated punctures, anterior margin narrowly arcuate. Face much broader than long, thickly coarse punctate with no indications of rugæ, at extreme base a thin sharp median carina which extends between antennæ, and from this to clypeus a broad, low, irregular ridge. Scrobes very short and broad, near to sockets very deep and nearly smooth, above rugose-punctate like the vertex; with several irregular, fine, longitudinal rugæ between scrobes and orbits. Vertex not concave, ocellocular distance slightly greater than width of ocellar area. Genæ broader throughout in side view than eye, very coarsely, somewhat sparsely punctured, malar area long, nearly equaling width of eye. Mesonotum with median basal area minutely, irregularly foveolate; the notauli are deeply suddenly impressed throughout, and connected basally by an arcuate impression; remaining surface densely, coarsely punctured. Scutellum sexfoveate basally, the disk coarsely, but smoothly, longitudinally rugose-punctate. Propodeum irregularly fine areolate, the median area of usual form, narrow, but with a strong complete median carina, and with several complete, oblique, stronger rugæ on lateral area; submedian and lateral teeth not evident; posterior concave face very strongly sculptured. Mesopleura coarsely, irregularly punctured, somewhat rugosely so below. Dorsum with humeral carinæ strong, straight and very close together, distance between them being only one-third of basal width of dorsum; entire surface to near apex very finely longitudinally reticulate-rugose; extreme apex smooth and shining. Abdomen shorter than head and thorax together, viewed from side very gradually deeper to the rather narrowly rounded apex, ventral concavity widely extended to the very apex; ovipositor entirely retracted in this specimen. Maxillary palpi with both second and third joints strongly swollen. Antennæ broken beyond twelfth joint, stoutly terete but evidently somewhat enlarged on apical third. Second abscissa of radius slightly longer than first and distinctly longer than second transverse cubital; third abscissa of radius distinctly arcuate. Nervulus postfurcal to one-third of first abscissa of discoidal.

Ebor (about 1,500 meters altitude), New South Wales (*Petersen*).

Resembling *A. laeviventris* in some respects, but distinct in size, coloration of wings, and other details. Possibly this species may be closer to *A. novoguineensis* than to any other. The form of the scrobes in this species tends toward that of the Malayan species.

Ascogaster detectus sp. nov.

Length, male, 2.5 millimeters.

Black; head pale ferruginous with exception of eyes and ocellar area, the mandibles unicolorous; scape pale ferruginous, flagellum shading into very dark ferruginous apically; legs entirely straw yellow, the hind tibiæ and tarsi slightly darkened apically. Abdomen with about basal half straw yellow, the terminal boundary of this area in the type rather irregular. Wings hyaline, veins all much paler than the dark brown stigma. Tegulæ sordid stramineous.

Clypeus shallowly, coarsely, and rather sparsely punctured, distinctly transverse and with anterior margin narrowly arcuate. Face much wider than long, the surface longitudinally impressed submedially, rather shallowly, finely rugose-punctate, the trend of rugosities being downward and mesad. Scrobes deep, but very short and broad, separated below by a delicate median carina, the inner surface like the entire vertex very finely, transversely rugulose with scattering punctures. Lateral ocelli very large, about twice size of anterior, the three subequidistant; ocellocular distance about equaling width of ocellar area. Sides of head long behind eyes, but rapidly incurved to occiput; in direct dorsal view the face is roundly somewhat protuberant before eyes. Mesonotum very coarsely, irregularly punctate on median basal area, less strongly and more sparsely punctate elsewhere, the lines of notauli somewhat impressed. Scutellum basally sexfoveate, the disk shining and very sparsely minutely punctured. Propodeum with very large, irregular, shallow areolæ which are coarsely, confluently punctured within; median area not separated; submedian and lateral teeth lacking. Disk of mesopleura coarsely, confluently punctured above, sparsely punctate and shining below. Dorsum with humeral carinæ strongly oblique; surface finely, thickly, longitudinally reticulate-rugose; entire apex smooth and shining. Viewed from side, abdomen is distinctly shorter than head and thorax together, gradually deepening posteriorly to the rounded apex; ventral concavity broadly extended to very apex. Antennæ broken beyond eighteenth joint, but terete throughout. First abscissa of radius slightly longer than second, but scarcely as long as second transverse cubital, the third abscissa slightly incurved. Nervellus postfurcal to about one-fourth of first abscissa of discoidal.

Botany Bay, New South Wales (*Petersen*).

Very close to *A. tricolor* Szepligeti, described from Mount Victoria, New South Wales, but much smaller, with the opaque vertex thickly, transversely rugulose and little punctate, the legs entirely pale yellowish, etc. Szepligeti's descriptions are too brief to make a detailed comparison possible. He speaks of the clypeus of *tricolor* as "rundlich" but it is undoubtedly transverse as in all other species.

Ascogaster vividus sp. nov.

Length, male, 3 millimeters.

Black; head vivid light ferruginous; mandibles darker at tips; scape concolorous with head, but flagellum piceous. Fore and middle legs pale ferruginous; hind legs largely piceous except trochanters and bases of tibiæ. Wing somewhat infumated, strongly so beneath the dark stigma; veins paler than stigma; from between stigma and prestigma a narrow pale band extends across the wing as in *A. cinctus*, but not white as in that species nor involving stigma. Tegulæ ferruginous.

Clypeus sparsely coarse punctate, the anterior margin narrowly subtruncate at middle; basal suture very strongly arcuate. Face thickly, coarsely punctured, with a few indistinct rugulæ next orbits; surface basally with two broad shallow submedian longitudinal impressions, which leave between them at base a very short, blunt, median ridge. Scrobes throughout with thick, concentrically transverse rugulæ and very sparse punctures, and no bounding rim except at sockets. Vertex transversely rugulose, with sparse punctures; the ocellocular distance a little greater than over-all ocellar width; the ocelli subequal in size, the distance between posterior much greater than to anterior; face slightly broadly protuberant before eyes. Entire depressed basal area of mesonotum with small irregular but distinct areolæ, which are narrowly extended along lines of notauli; remainder of surface thickly coarsely punctured. Scutellum septemfoveate at base, the disk smooth and shining and with few minute punctures.

Propodeum with a semicircular rimmed median area on posterior half of upper surface, the basal half represented only by a strong median carina; lateral to this occur several strong oblique rugæ; the surface otherwise with small irregular areolæ; posterior rim without teeth; terminal concave face strongly sculptured. Disk of mesopleura in large part with small irregular areolæ, lower posterior part smooth and shining. Dorsum with the rather long and strong humeral carinæ parallel on disk of basal third; remainder of surface thickly, sharply, longitudinally, reticulately rugulose, with sharply defined, small angular areolæ on the apical third; on extreme apex these become thick, oblique, irregular rugulæ. Viewed from side the abdomen is distinctly shorter than head and thorax together, rather rapidly deepening to the broadly rounded apex; ventral concavity broadly extended to very apex. Antennæ with scapes rather short and thick; flagellum broken beyond twenty-third joint, all joints teretely elongate; even in this broken condition nearly as long as body. First abscissa of radius much longer than second, or than second transverse cubital; third abscissa of radius rather strongly incurved. Basal vein, second abscissa of cubitus (especially distad), and first abscissa of radius strongly broadened. Nervellus postfurcal to about one-fourth of first abscissa of discoidal.

Illawarra, New South Wales (*Petersen*).

Szepligeti described only one red-headed *Ascogaster* (*A. tricolor*) from Australia. It now appears certain that there is a group of species in Australia closely related to *A. tricolor*. The matter is greatly complicated, not only by the very incomplete description of *A. tricolor*, but also by the great difficulty of distinguishing and properly associating the sexes, with the scant and imperfect material now at hand. The genitalia in all of these species are closely retracted and, though the ventral concavity in all extends in full width to the apex, still examination is very difficult without dissection. Also, most of the other genera do not show the very striking sexual differences so apparent in the antennæ of many *Chelonus* and described by Marshall long ago. There is here, therefore, the greatest need for collecting large series, as has been done with many Malayan species in other groups. So far, all species of this genus have come to us in very few specimens.

A single specimen with broken antennæ, also from Illawarra, may be the female of this species. While the general appearance of the insect is very similar, the differences in detail are sufficient to make this reference a tentative one until more material shall have been obtained. It differs from the male as follows:

Length, female, 3.25 millimeters. Head less brightly ferruginous. Wing less strongly infumated and the hyaline cross-band less conspicuous. Hind legs pale yellowish like the others. Abdomen with basal third suffused, very dark ferruginous, this coloration very inconspicuous. Tegulæ pale stramineous.

Clypeus with broad median portion of basal suture straight, not at all arcuate; disk smooth and shining with very few minute punctures. The basal areolate area of mesonotum narrower. Scutellum with larger and somewhat more numerous punctures. First abscissa of radius subequal to second abscissa and to second transverse cubitus.

Ascogaster distinctus sp. nov.

Length, female, 3 millimeters.

Differs from *A. vividus* as follows: The ferruginous of head less vivid. Inner surface of scapes darkened. Legs all very pale ferruginous except tips of hind tibiæ and hind tarsi which are piceous. Wing less strongly infumated and with transverse hyaline band less conspicuous; tegulæ stramineous. Abdomen with basal third clear stramineous.

Clypeus nearly smooth, with very few punctures. Face without appreciable rugulæ near orbits. On depressed basal area of mesonotum a sharp, strong, median carina, the areolæ on either side of this showing a distinct tendency to longitudinal arrangement. Scutellum with only four very large foveæ at base, the disk covered with large punctures separated by at least their own diameter. Ovipositor very shortly exserted in this specimen. Antennæ broken beyond the twenty-sixth joint. Basal vein not evenly arcuate, suddenly bent near base, then straight to prestigma.

Illawarra, New South Wales (*Petersen*).

Very close to *A. vividus*, but distinguished by differences in clypeus, mesonotum, and scutellum. While material at hand does not furnish any basis for estimating the range of variation in this group, still it seems that this form cannot be associated with the female above tentatively referred to *A. vividus*.

Ascogaster maculaticeps sp. nov.

Length, male, 3.5 millimeters.

Black; head and legs nearly of same shade of pale ferruginous; nearly entire vertex, to very near orbits, black; hind tibiæ nearly white on basal half. Wings slightly infumated on distal half, with a very faint indication of the transverse hyaline band of other members of this group. Veins somewhat paler than the dark stigma, the median much paler. Tegulæ stramineous.

Differing from *A. vividus* in structure as follows: Clypeus nearly as thickly coarse punctate as the face. Face very short, the blunt median ridge extending to clypeus. The sharp, strong, transverse rugulæ of vertex interspersed with large punctures, these denser behind ocelli. Notauli distinctly foveolate nearly to anterior border of mesonotum. Scutellum quinquefoveate at base, the disk covered by large punctures which are mostly not separated by as much as their diameter. Propodeum with the median area larger and somewhat longer, and the basal median carina therefore shorter, the lateral areolation much stronger, with rims of areolæ sharply raised, and without lateral oblique rugæ. Mesopleuræ with very large punctures, these larger and coalescent above; a deep, curved, longitudinal, somewhat oblique impression extends from middle of fore margin caudad and downward to hind margin, this broad groove being occupied throughout by vertical foveolæ. Dorsum with the small, sharply defined, apical areolæ occupying nearly all of apical two-thirds. Antennæ 27-jointed and a little longer than the entire body. First abscissa of radius equal to second and these each slightly longer than second transverse cubital, and with first transverse cubital and second abscissa of cubitus swollen to greater diameter than other veins. Nervulus a little longer postfurcal.

Botany Bay, New South Wales (*Petersen*).

This is the most distinct species among the red-headed forms, widely separated, inter alia, by the broad discal groove of mesopleura.

Genus **CASCOGASTER** novum

This group, as characterized in the above generic synopsis, presents a greater departure from normal *Ascogaster* than has yet been indicated by any author for this assemblage. The position of the median ocellus is distinctive. The head is more swollen and more approaching subcubical than in *Ascogaster*. The character of the sculpturation is likewise unique.

In 1919, Fullaway described a species from Java[11] (*rugosa*) which he placed in *Ascogaster*, and which evidently pertains to *Cascogaster*. It exhibits the characteristic position of ocelli, and the first discoidal cell is described as "petiolate," which evidently refers to the very distinctive origin of the cubitus on the basal vein considerably below the prestigma. Fullaway does not, however, mention any special formation of protuberant denticles in any part of the margins of scrobes—a very conspicuous development in each of the three species now at hand.

Type *C. fullawayi* sp. nov.

Synopsis of species of Cascogaster g. nov.

MALES

a^1. Abdomen ovate oblong in outline (dorsal view), widest at middle, the narrowing to the short acute apex confined to apical third; abdomen black.
  b^1. Length, 3 millimeters; nervellus "almost interstitial." **C. rugosa** Fullaway.
  b^2. Length, 4 to 4.25 millimeters; nervellus postfurcal to at least one-fourth of first abscissa of discoidal.
    c^1. Face with a strong laminate prominence at middle; lateral scrobal rims at middle extended into high, strong teeth which are higher than sockets and very conspicuous; first abscissa of radius a little longer than second; length, 4 millimeters. **C. fullawayi** sp. nov.
    c^2. Face medially carinate but without strong prominence at middle; lateral scrobal rims inconspicuously obtuse angulate at middle; first abscissa of radius distinctly shorter than second; length, 4.25 millimeters........ **C. malayensis** sp. nov.
a^2. Abdomen long triangular in outline, widest at base, the narrowing to the long acute apex beginning on basal third; the color of abdomen very dark ferruginous; scrobal teeth of great size and very prominent; length, 3.5 millimeters........ **C. coelioxoides** sp. nov.

Cascogaster fullawayi sp. nov.

Length, male, 4 millimeters.

Black; antennæ and fore and middle legs very dark ferruginous, the tarsi paler; hind legs with coxæ black, femora and tibiæ piceous. Wings palely infuscated, much more darkly so in apical half of first cubital cell, and all of second cubital and radial cells, this coloration bordered basally by a hyaline line passing from prestigma obliquely through middle of first cubital cell. Palpi pale yellowish; mandibles black, with dark ferruginous tips, tegulæ very dark ferruginous.

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[11] Journ. Straits Asiat. Soc. **80** (1919) 48.

Clypeus strongly and subangularly arcuate basally and apically, the surface smooth and shining and sparsely, minutely punctured. Face with length about three-fourths of width, surface completely covered by large, deep, sharp-rimmed areolæ; at center of median line a very short, high laminate carina; from the high, raised, outer angles of antennal sockets several strong rugæ extend downward and toward center of face; centrally and above these rugæ, the areolæ are smaller. Between the antennæ a very high and very thin laminate median carina. Inner orbits parallel. Scrobes smooth and shining within, but with coarse, widely separated, transverse wrinkles; scrobes outwardly margined by high, thin, complete carinæ which near the middle are raised into sharply angulate teeth; outside these rims are several very large and very deep areolæ with smaller ones next orbits. Vertex entirely coarsely areolate. Eye of usual form but small, the malar space nearly as long. Genæ of great and subequal width throughout, nearly twice width of eye, the surface obliquely areolate, the blunt, low rims thick and bearing scattering, minute punctures. From above, the thick head has the very strongly white pubescent face scarcely at all prominent, but conspicuously marked by the lateral scrobal teeth, the high, sharp-rimmed, and very prominent antennal sockets, and the central facial lamina which is clearly visible in dorsal view. Mesonotum entirely covered by large, subequal, deep, sharp-rimmed areolæ of irregular arrangement, the position of notauli obscurely marked by broad, shallow, oblique impressions. Scutellum trifoveate basally, the disk with a high, sharp, median ruga and two lateral rugæ on either side, between these ill-defined areolæ. Pleuræ and propodeum sculptured like the mesonotum, but even more coarsely so, the transverse posterior rim of latter with submedian and lateral teeth very large, obtuse-angular, and strongly protuberant, the upper face of propodeum medially very short. Dorsum with the short humeral carinæ very strong and oblique; entire surface deeply sculptured with small longitudinal areolæ, these having within them many smaller, rounded areolæ. Hind coxæ distinctly transversely rugose-punctate. Abdomen acute apically, its extreme apex with a short acute teatlike extension; viewed from side the depth is but little greater subapically than basally, the ventral concavity extending but two-thirds of ventral length. Antennæ 41-jointed, a little longer than entire body, scapes rather slender, reaching behind ocelli; flagellum somewhat thickened on middle third, the tips strongly attenuate, the basal joints elongate and terete, from tenth to near end very short and as broad as long or but little longer. Wing with both first abscissa of cubitus and first abscissa of discoidal strongly bisinuate. First abscissa of radius slightly longer than second which equals second transverse cubitus; the third abscissa of radius straight. Nervulus postfurcal to one-fourth length of first abscissa of discoidal, the intervening portion of discoidal markedly thickened.

Baguio, Benguet Subprovince, Northern Luzon (*Baker*). Another specimen from a not-distant mountain locality, Imugan, Nueva Vizcaya Province (*Baker*).

Cascogaster fullawayi var. **maquilingensis** var. nov.

A specimen that does not appear to represent more than a varietal form of this species was taken on Mount Maquiling, in central Luzon, which locality is separated from the mountain localities of the typical form by the broad interior plains of central Luzon. This variety differs from the typical form as follows:

Clypeus with sparse but large punctures. Face with the high interantennal lamina, and the median facial prominence, connected by a distinct median carina which also extends to clypeus. Scutellum quinquefoveate at base, the disk with about six irregular subequal longitudinal rugæ.

Cascogaster malayanus sp. nov.

Very similar in general habitus to *C. fullawayi,* but differing as follows:

Length, male, 4.25 millimeters. Antennæ with scape and basal half of flagellum pale ferruginous. Fore and middle tibiæ with piceous shadings.

Clypeus of similar form basally but with apical margin broadly arcuate, its surface thickly, coarsely punctate. Face with a strong, even, percurrent median carina which lacks any raised laminate prominence at middle. The interantennal lamina is here developed into a stout, acutely triangular tooth (frontal view) which is medially carinate to its apex. Face nearly as long as broad, the surface areolæ smaller and therefore much more numerous. The sharp, high lateral rims of scrobes obtuse-angularly raised at middle, but not forming erect, acute teeth.

Malar space not as long as the eye. Genæ very broad below, but distinctly narrowing above. Notauli more narrowly and strongly depressed, median rugæ forming a very strong, complete median carina which is highest and strongest at base and bordered on either side by regular rows of areolæ. Scutellum with three very large foveæ at base, the middle one very large and deep and with its sharp lateral rims continued caudad across entire length of disk, the surface otherwise irregularly shallowly rugose. Antennæ broken beyond twenty-eighth joint. First abscissa of radius a little shorter than second, subequal to second transverse cubital; third abscissa of radius very slightly incurved.

Singapore (*Baker*).

This species is apparently closely related to the *"Ascogaster" rugosa* of Fullaway. The original description of that species is largely devoted to form of sclerites and similar characters, most of which are common to the whole genus, or tribe, or subfamily, while specific details of sculpturation and conformation are not mentioned. It is therefore impossible to make any satisfactory comparison. However, the length given for *rugosa,* 3 millimeters, would separate it from either *fullawayi* or *malayanus.* The nervellus of *rugosa* is also described as "almost interstitial," while in the other species known it is strongly postfurcal. Fullaway makes no mention of the various modifications of antennal sockets and scrobal rims which occur in these species, and which will also doubtless be found in some form in *rugosa.* Whether these conspicuous modifications are sexual or not is uncertain, but there is no such development in any true *Ascogaster* of Malaya or Australia, so far as known.

Cascogaster coelioxoides sp. nov.

Length, male, 3.5 millimeters.

Black, with the abdomen throughout a very dark ferruginous. Antennæ pale ferruginous, darker on apical third. Fore and middle legs sordid ferruginous, hind legs piceous. Wings colored as in the other species, but even more strongly infumated. Tegulæ ferruginous. Mandibles ferruginous, darker at tips.

Differing from *C. fullawayi* in structure as follows: Face with a high, sharp, even median carina on upper half, which reaches to apex of interantennal denticle. Lateral scrobal rims at middle projected vertically in very large, broad, subtruncate-tipped teeth, which project beyond the appressed scapes and which are conspicuously visible in both dorsal and ventral views. Areolæ of vertex and thorax of great size and depth. Notauli indicated only at sides of mesonotum by narrow impressions, scutellum trifoveate at base, the disk irregularly small areolate. Propodeum deeply depressed between the very large submedian teeth. Dorsum with the short humeral carinæ very wide apart, nearly parallel, between them with very large, high-rimmed, longitudinal areolæ; remainder of surface with smaller areolæ of the same type but with the thin rims bulging around frequent large punctures borne on their edges. While the abdomen above is strikingly different in outline, as indicated in the above synopsis, the lateral view is not dissimilar to that of *fullawayi,* though the very acute apex appears as a more extended teatlike projection. First and second abscissa of radius subequal and a little longer than second transverse cubital; third abscissa of radius straight. Nervellus postfurcal to one-fifth of first abscissa of discoidal. Antennal scapes small, scarcely reaching ocelli, and rather narrow, their surfaces shagreened, and coarsely, sparsely, shallowly punctured.

Singapore (*Baker*).

This remarkable species has quite the form of a minute female *Coelioxys.* It will be of the greatest interest to secure the female.

Genus **MEGASCOGASTER** novum

With the cyclostomine genus *Gastrotheca* standing in the Cheloninæ, there are a few Malayan species which would be thrown into it by current synopses. Apparently one of these has been described as *Gastrotheca sumatrana* by Enderlein,[12] though this transfer cannot now be substantiated. These species agree with *Gastrotheca* in some of the venational characters used in current synopses, but the fact that the Malayan forms are noncyclostomine and the nervellus is always postfurcal (usually far) shows that the Malayan forms have no relation to the African *Gastrotheca.* Certain females in several genera of true Cheloninæ have the abdomen apically bidentate, but this is a sexual character not occurring in all the species, even of the same genus. It seems quite doubtful, however, that the *Gastrotheca sumatrana,* with apically bidentate carapace, pertains to this group at all. It may belong to *Megachelonus,* where similarly armed females are found.

Megascogaster is unique in form of body, sculpturing, propodeal characters, and venation.

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[12] Stett. Ent. Zeit. **66** (1905) 236.

Megascogaster elongatus sp. nov.

Length, male, 5.5 millimeters.

Black, head and thorax with rather extensive smooth shining areas. Antennæ basally pale ferruginous, becoming piceous on apical three-fourths. Mandibles dark ferruginous. Fore and middle legs pale yellowish; hind legs dark ferruginous with base of coxæ, tibiæ, and tarsi piceous. Wings hyaline, stigma dark brown, veins with prestigma, pale stramineous. Tegulæ stramineous.

Clypeus and face smooth and shining, with sparsely set large punctures. Clypeus large, the basal suture very strongly arcuate, anterior margin obtuse-angularly extended, the apex notched. Face distinctly broader below than above, a little wider than long, with narrow, longitudinal impressions either side of median line, the lateral areas rather strongly bulging, and with a strong median carina on basal half, which is highest between antennæ and which separates scrobes. Scrobes with lateral rims high and sharp throughout, and between these and orbits a single very strong, sharp, longitudinal ruga; inner surface of scrobes smooth and shining. Outline of head from above transverse subrectangular, the genæ very strongly developed behind eyes and the width across genæ about as great as that across eyes. Ocellar area and ocelli relatively very small; ocelli subequidistant; ocellocular distance much greater than over-all ocellar width. Surface of vertex smooth and shining, sparsely coarse punctate, with a few small irregular areolæ in front of lateral ocelli. Malar space more than half length of the large eyes. Genæ very broad below, narrower above, smooth and shining, sparsely coarse punctate. Mesonotum of the rather short, anteriorly broadly rounded type, basal depressed area with very large, transverse, rather regularly arranged areolæ which are deep, sharp-rimmed, and within more or less subdivided; remainder of surface smooth and shining and sparsely coarse punctate; course of notauli indicated by lateral extension of small areolæ, the rows of which curve strongly downward to the sides.

Scutellum sexfoveate basally, the disk smooth and shining and sparsely coarse punctate. Propodeum covered by very large, deep, sharp-rimmed areolæ, a median area represented by a longitudinal row of three larger areolæ, which extend full length of upper face; hind margin of upper face sharp-rimmed, but nearly truncate, and without either submedian or lateral teeth.

Dorsum with the short humeral carina straightly parallel and as far from each other as from lateral margins, between these three longitudinal costulæ, and outside three or four more; the costulæ extend two-thirds length of dorsum, between them numerous small, elongate, compound areolæ; beyond this broken up into a thick-set maze of small areolæ, these becoming obsolete on the shining teatlike apical extension. The abdomen is longer than head and thorax together, very narrow, subparallel-sided, narrowed on the apical fourth to the teatlike apex; viewed from the side of subequal depth throughout, the ventral concavity extending to three-fourths the length. Mesopleura obscurely areolate above, smooth and sparsely punctate below, traversed by a broad and deep longitudinal median groove, which is transversely areolated. Antennæ 33-jointed, slender, terete, the tips slenderly attenuate; scapes very small and short, not surpassing anterior ocellus, but the annellus longer than wide. First abscissa of radius subequal to second transverse cubitus, these both distinctly shorter than second abscissa; third abscissa straight. First transverse cubitus strongly upcurved toward the stigma. Nervellus very shortly postfurcal. Second discoidal cell unusually large and long, subrectangular.

Female, length, 6 millimeters; very similar in all respects to male and with same form of abdomen, clypeus, scrobes, etc. Also, coloration is practically identical. The sides of abdomen are not parallel, but outcurved slightly. The slender ovipositor (not valves) is exserted in this specimen to one-fourth length of abdomen.

Dapitan, northwestern Mindanao (*Baker*).

Very fortunately, the two specimens taken of this fine species represent the two sexes, and the very close similarity of the two sexes is noteworthy—a condition totally different from that found in *Megachelonus*, for instance.

NOTES ON ORIENTAL DIPTERA, WITH DESCRIPTIONS OF NEW SPECIES

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ONE TEXT FIGURE

In this paper are presented descriptions of some new genera and species of Diptera, mostly from the Philippines, and notes on some previously described species which are imperfectly known. The new genera are strikingly distinct from any previously described in their respective families; the outstanding characters are plainly indicated under each. Where several species of a genus are described a synopsis of the species involved is given to facilitate their identification.

DROSOPHILIDÆ

Genus **LUZONIMYIA** novum

Generic characters.—Arista with short hairs above and below, the longest not much longer than its basal diameter; face not carinate; ocellar bristles represented by a pair of microscopic hairs in transverse line with anterior ocellus; postverticals short; all three orbitals distinct, the proclinate pair in front of and in line with the anterior reclinate pair; mouth margin slightly produced, vibrissæ very small. Thorax without a humeral bristle, the mesonotum otherwise as in *Drosophila*, the prescutellar pair of acrostichals strong, situated proximad of the posterior pair of dorsocentrals; sternopleura with two long bristles. Fore tibia without a preapical bristle. Wing as in *Drosophila*.

Genotype, the following species.

Luzonimyia nigropuncta sp. nov.

Female.—Head black, densely whitish gray pruinescent; antennæ testaceous yellow, third segment largely darkened; palpi black. Thorax black, densely pale gray dusted; apical margin of scutellum testaceous yellow. Abdomen testaceous yellow, tergites from third visible one to apical each with a pair of round, deep black spots on disk. Legs testaceous yellow. Wings clear. Halteres pale yellow.

Frons fully 1.5 times as long as wide, without fine surface hairs; eyes descending to almost extreme lower margin of head, the cheek subobsolete. Thorax with about ten series of intradorsocentral hairs; scutellum flattened on disk, bare. Legs as in normal species of *Drosophila.* Inner cross vein a little before middle of discal cell; first costal section about one-fifth as long as second, and about 1.5 times as long as third; penultimate section of fourth vein about four-fifths as long as ultimate, the latter deflected apically so that the first posterior cell is gradually widened to apex; outer cross vein at about two-thirds of its own length from apex of fifth vein.

Length, 2 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

This genus has much in common with *Aclotoxenus* Frauenfeld, but the latter has but one pair of dorsocentrals, and differs in several other respects.

AGROMYZIDÆ

Ochthiphila luzonensis sp. nov.

Female.—Head black, densely gray dusted; antennæ and palpi orange yellow, third segment of former a little darker around apex. Thorax and abdomen black, densely gray dusted, former not vittate, the abdomen with an opaque deep black spot on each side of each tergite, not visible from above on the basal segment but becoming progressively more obvious apically, and on the apical two or three segments connected with a spot on each side of disk by means of a transverse black streak. Coxæ and femora fuscous, with gray dusting; tibiæ and tarsi orange yellow. Wings whitish hyaline, veins pale at bases, dark at apices. Halteres whitish yellow.

Frontal bristling normal, the postverticals a little shorter than the ocellars; upper apical angle of third antennal segment quite pronounced. Presutural intradorsocentral area with two widely separated series of fine short hairs; basal pair of scutellar bristles shorter than apical pair. Femora as usual rather stout. Inner cross vein at middle of discal cell.

Length, 3 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

This species is distinguished from its allies by the markings of the abdomen, the short basal scutellar bristles, and the color of the antennæ and palpi.

GEOMYZIDÆ

Genus **TENUIA** novum

Generic characters.—Ocellars and postverticals long, the former divergent, the latter convergent; the four verticals long; each orbit with three bristles, all backwardly directed, the upper one curving a little outwardly; face narrowest at middle, central part concave below, tumid at the upper extremity, the central upper part with some microscopic hairs; a distinct fovea below each antenna which tapers off at vibrissa; cheek narrow, with a series of setulæ along middle to the long vibrissa; proboscis stout; palpi normal. Thorax with 1 + 4 long pairs of dorsocentrals, one humeral, one posthumeral, two notopleurals, one supraalar, one pair of prescutellar acrostichals, one sternopleural, one long and one short postalar, and one propleural; basal pair of scutellar bristles very short. Legs long, tibiæ and tarsi slender, preapical tibial bristle minute. Auxiliary vein fused with first at its apex; costa with short but distinct bristles from beyond first vein to apex of second; sixth vein thick, abruptly discontinued at about three-fourths of the distance to margin of wing.

Genotype, the following species.

Tenuia nigripes sp. nov.

Female.—Head black; frons brown, becoming yellowish anteriorly; entire orbits, including postocular, whitish yellow; cheek with a black mark posteriorly; face the same color as orbits, the foveæ black; antennæ and arista black, the former reddish below; palpi brown. Thorax and abdomen black, slightly shining, sparsely gray dusted, dorsum of thorax with traces of three dark vittæ, and the humeri, lateral margins of mesonotum, margin of scutellum, upper part of hypopleura, and the vertical mesopleural suture yellow; the connecting membrane between tergites yellow, but sometimes hidden. Legs black, fore coxæ yellowish in front. Wings grayish. Fringes of calyptræ brown. Halteres yellow.

Eyes bare; third antennal segment not as long as wide; arista pubescent; cheek about one-sixth as high as eye; parafacials narrow. Dorsum of thorax with sparse hairs, that of scutellum flattened and with very few hairs. Abdomen with six visible tergites. Posteroventral bristles on fore femur present only apically; fore tarsus distinctly longer than fore tibia; hind femur with two apical short bristles, one anteroventral and one posteroventral. Wing about three times as long as its greatest width; first posterior cell narrowed a little to apex; inner cross vein a little beyond middle of discal cell and distinctly beyond apex of first vein; outer cross vein at less than its own length from apex of fifth vein.

Length, 4.5 millimeters.

Type, Baguio, Benguet Subprovince, Luzon (*Baker*).

This genus belongs to the Opomyzinæ and is distinguished from other genera in that subfamily that have presutural dorsocentrals by the immaculate wings, presence of postverticals, possession of three pairs of orbital bristles, the bare mesopleura, and minute preapical tibial bristle.

CHLOROPIDÆ

CHLOROPINÆ

Genus **CHALCIDOMYIA** de Meijere

Frey records six species of this genus from the Philippine Islands, but I have only two of these on hand at this time.

Chalcidomyia aeneiventris de Meijere.

One specimen, Mount Maquiling, Laguna Province, Luzon (*Baker*).

This species is distinguished from its congeners by the lack of an apical dark spot on wing, and the entirely blue-black thorax and abdomen.

Chalcidomyia apicalis de Meijere.

Four specimens, Mount Maquiling, Laguna Province, Luzon (*Baker*).

Distinguished from its congeners by the presence of an apical dark spot on wing, the entirely yellow legs, and the large yellow mark on apex of abdomen which begins near base of third tergite and extends to tip. I have been unable to distinguish any yellow mark on the sternopleura, such as de Meijere mentions in his description of this species.

MUSCIDÆ

PHAONIINÆ

Genus **HELINA** Robineau-Desvoidy

This genus is distinguished from *Dichaetomyia* Malloch by the bare prosternum, pteropleura, and third wing vein, and from *Helinella* and *Eumyiospila,* both of which are described in this paper, by the last character only.

There are several species before me, which can be distinguished by means of the following synoptic key.

Key to the species of Helina Robineau-Desvoidy.

1. Hind femur of male with rather dense soft long hairs on ventral surfaces basally, longest on posteroventral, the anteroventral surface with four or five long, strong bristles on apical third or fourth; thorax with four pairs of postsutural dorsocentral bristles; abdominal paired dorsal spots very conspicuous; fore tibia without a median posterior bristle; sternopleurals 2 + 2; hind tibia with a short posterodorsal setula basad of middle .... **H. hirtifemorata sp. nov.**

   Hind femur in neither sex with long ventral hairs; thorax with three pairs of postsutural dorsocentral bristles .... 2.

2. Sternopleurals 1 + 2; scutellum yellow, contrasting sharply with the brownish or black mesonotum, the latter with two narrow submedian and two broader sublateral dark vittæ, the sides of scutellum with short hairs below level of the strong bristles basally; palpi fuscous, apices sometimes faintly pale; fore tibia without a median posterior bristle, but with a setula near middle on anterodorsal surface; legs yellow, tarsi fuscous .... **H. coronata (Stein).**

   Sternopleurals 2 + 2; scutellum black, colored as mesonotum, and bare below the level of the strong bristles .... 3.

3. Fore tibia without a posterior median bristle; hind tibia without a posterodorsal bristle near base; eye facets of male larger than usual on upper half; anterior pair of presutural dorsocentral bristles not over one-third as long as the posterior presutural pair; inner cross vein of wing very obviously clouded .... **H. mindanaensis sp. nov.**

   Fore tibia with a median posterior bristle; hind tibia with a short posterodorsal bristle near base; eye facets slightly enlarged above; anterior pair of presutural dorsocentral bristles nearly as long as the posterior pair .... 4.

4. Legs in male tawny yellow, bases of fore, and sometimes of mid, femora darkened, tarsi black; abdomen hardly shining, densely gray dusted, with a pair of distinct, though small, dark subtriangular spots on tergites 2 and 3, and dark dots at bases of some of the long bristles. **H. flavidipennis (Stein).**

   Legs in male black, tibiæ and extreme apices of femora paler, sometimes tawny yellow; abdomen distinctly shining, evenly and rather thinly brownish dusted, without dark dorsal spots. **H. nigroabdominalis sp. nov.**

Helina hirtifemorata sp. nov.

Male.—Black, densely yellowish gray pruinescent. Face and orbits with dense silvery gray pruinescence; interfrontalia black; antennæ and palpi black. Thorax with four black dorsal vittæ that are not continued to hind margin and are most distinct when the thorax is seen from behind. Abdomen with three pairs of round black dorsal spots, one on each tergite from second to fourth, the pair of fourth least distinct, and sometimes a faint dark dorsocentral line. Legs black, knees yellowish, tibiæ brownish. Wings clear, cross veins not distinctly clouded. Calyptræ and halteres yellowish.

Eyes bare; frons at narrowest point wider than third antennal segment; arista plumose. Thorax with 2 + 4 dorsocentrals, prealar minute, sternopleurals 2 + 2. Abdomen subcylindrical, the tergites with rather strong apical bristles; fifth sternite with only the usual hairs. Fore tibia without a median posterior bristle; mid femur with a few long bristles on basal half of posteroventral surface; mid tibia with about four posterior bristles; hind femur with rather dense long hairs on more than the basal half of ventral surfaces, about six long bristles on apical half of the anteroventral, and very long, closely placed, setulose hairs on posterior surface from base to one-third from apex, where they abruptly cease; hind tibia with one or two posterodorsal setulæ near base, three anterodorsal, and four or five anteroventral bristles. Costal thorn conspicuous.

Length, 6.5 millimeters.

Type, allotype, and six paratypes, Baguio, Benguet Subprovince, Luzon (*Baker*).

The female has, as usual, the frons fully one-third of the head width and, except for the lack of long ventral hairs on hind femur, is similar to the male.

Helina coronata (Stein).

I have before me two female paratypes of this species sent on loan by Dr. C. F. Baker, which agree perfectly with a female from Mount Maquiling. All three lack hairs on the hypopleura, while a series of both sexes from Sumatra, which appear to belong to this or a very closely allied species, have a few fine hairs both on the upper anterior margin and below the spiracle. All the specimens have short black hairs on sides and margin of ventral surface of scutellum basally, the dorsocentrals 2 + 3, the prealar bristle very short, arista plumose, and fore tibia with a short anterodorsal bristle near middle, but no median posterior bristle.

Helina mindanaensis sp. nov.

Male.—Black, densely yellowish gray pruinescent. Thorax rather inconspicuously quadrivittate with black. Abdomen with a pair of poorly defined, large, brown spots on each tergite from second to fourth, and faint brown dots at bases of the bristles. Legs fuscous, extreme apices of femora, and all of tibiæ, yellowish testaceous. Wings grayish hyaline, inner cross vein slightly clouded. Calyptræ and halteres yellowish.

Eyes with very short sparse hairs; frons not over the width of third antennal segment; arista plumose. Thorax with 2 + 3 dorsocentrals, the anterior presutural pair very short; prealar lacking; sternopleurals 2 + 2. Abdomen elongate ovate, rather strongly bristled apically, fifth sternite without exceptional bristling. Fore tibia without a median posterior bristle; mid tibia with two short posterior bristles; hind femur with three or four long preapical anteroventral bristles; hind tibia with one anteroventral and two anterodorsal bristles, no setula on posterodorsal surface near base. Last section of fourth vein over twice as long as preceding section.

Length, 5 millimeters.

Mindanao, Surigao Province, Surigao (*Baker*), type.

Helina flavidipennis (Stein).

I assign to this species a number of specimens that have the same general color as the preceding species, but the legs are honey yellow with black tarsi, and there is rarely a slight darkening of the bases of fore and mid femora, the abdomen in male is densely brownish gray dusted, with paired dark spots on tergites 2 and 3, and dark dots at bases of some of the larger bristles. The wings are distinctly yellow at bases, the costal spine is long, and the penultimate section of fourth vein is about two-thirds as long as ultimate section. All the dorsocentrals (2 + 3) are long, and the presutural acrostichal hairs are in two series.

Length, 6 to 9 millimeters.

Locality, Baguio, Benguet Subprovince, Luzon (*Baker*).

Helina nigroabdominalis sp. nov.

Differs from the preceding species only in being more uniformly black, the abdomen being a drab color without dark dorsal spots, at least in the male. Both species have at least one posterior median bristle on the fore tibia and one posterodorsal bristle near base on hind tibia.

Length, 6 to 9 millimeters.

Type, male, allotype, and nineteen paratypes, Baguio, Benguet Subprovince, Luzon (*Baker*).

It is possible that this is only a variety of the preceding species.

Genus **HELINELLA** novum

This genus is distinguished from *Helina* by the presence of some setulose hairs on the undersurface of third vein at base.

Genotype, *Mydaea propinqua* Stein.

I have before me two species of the genus which can be distinguished as follows:

Bases of tarsi broadly yellow; abdomen in neither sex yellow at base, the dorsal dark spots small, rather widely separated in middle of tergites.......... **H. propinqua** (Stein).

Tarsi entirely black or fuscous; abdomen in male broadly translucent yellow at base, the black dorsal spots very large and separated by a mere line on middle of tergites.......... **H. otanesi** sp. nov.

Helinella propinqua (Stein).

Male.—Black, slightly shining, densely brownish gray dusted. Face, cheeks, and orbits white dusted, interfrontalia black when seen from behind; antennæ and palpi black. Thoracic dorsum quadrivittate with black. Abdomen with central part of first tergite and two variable-sized and poorly delimited subtriangular marks on second, and another on third tergite, dark brown or fuscous, fourth tergite less evidently marked. Legs dusky testaceous yellow, coxæ and femora fuscous, apices of tarsi darkened. Wings brownish hyaline. Calyptræ and halteres yellowish.

Frons a little wider than third antennal segment, orbits setulose on their entire length, not obliterating the interfrontalia; arista plumose; parafacial in profile almost obsolete; cheek about 1.5 times as high as width of third antennal segment; palpi not much widened in male, distinctly widened in female. Thorax with $2 + 3$ dorsocentrals, and sometimes a very short setula just behind suture; anterior pair of presutural dorsocentrals rather short; anterior intraalar absent or minute; prealar hardly distinguishable; scutellum bare on sides. Abdomen ovate, basal sternite bare, tergal bristles strong apically. Fore tibia without a median posterior bristle; mid tibia with two posterior bristles; hind femur with three to five preapical anteroventral bristles, and some setulose hairs on basal half of posteroventral surface; hind tibia with one anterodorsal and one anteroventral bristle. Fourth wing vein almost straight; last section of fourth vein about twice as long as the preceding section.

Length, 6 to 8 millimeters.

Localities, Cuernos Mountains, Occidental Negros; Mount Maquiling and Los Baños, Laguna Province, Luzon (*Baker*).

Some of the specimens are much smaller than others, but do not differ in other respects.

Helinella otanesi sp. nov.

Male and female.—This species is structurally similar to the foregoing, but can be readily distinguished from it by the characters given in the specific diagnosis. The female has the abdomen black at base but, like the male, it has the tarsi black, the abdominal dorsal spots very large, and the sublateral thoracic vitta broader and with a brownish suffusion along its sides.

Length, 8 millimeters.

Type, male, allotype, and two male paratypes, Laguna Province, Los Baños; female paratype, Mount Maquiling, Luzon (*Baker*).

I have before me a female from Sumatra that has the femora yellow, and which in some other respects does not agree exactly with the females of *otanesi;* but the material is insufficient to permit of a definite decision as to its specific identity.

The above species is dedicated to Faustino Q. Otanes, a very promising Philippine entomologist, in memory of my association with him in the United States.

Genus **EUMYIOSPILA** novum

This genus differs from *Myiospila* in having the fourth wing vein almost imperceptibly curved forward apically, the interfrontalia of the female without a pair of cruciate bristles, and the anterior intraalar bristle absent or minute. In both the species known to me the males have the anteroventral surfaces of the femora armed apically with a series of short, stout, closely placed, black bristles, least developed on the fore pair.

Genotype, *Eumyiospila spinifemorata* sp. nov.

There are two species of the genus known to me, the distinguishing characters of which are as follows:

Antennæ fuscous, apex of second and base of third segment yellowish, femora in both sexes honey yellow........................ **E. spinifemorata sp. nov.**

Antennæ with the third segment entirely pale honey yellow; femora with a greater or lesser proportion of basal section black, sometimes to well beyond middle.. **E. contraria Walker.**

Eumyiospila spinifemorata sp. nov.

Male and female.—Head black, with white dusting, extreme apex of second, and base of third antennal segment yellowish; palpi black. Thorax black, rather densely gray dusted; humeri and scutellum testaceous yellow, the latter darkened at base, dorsum of thorax distinctly vittate; when seen from behind there are two broad vittæ along the lines of dorsocentrals, and two laterad of these which are broken at suture, but when the dorsum is viewed from in front the dark and light vittæ are transposed. Abdomen brownish, yellowish translucent at base, each tergite except the first with a pair of large black discal spots, least conspicuous on fourth. Legs yellow, coxæ and femora blackish. Wings yellowish, most noticeably so at bases. Calyptræ and halteres yellowish.

Eyes bare: frons in male as wide as third antennal segment, orbits setulose on their entire length; frons of female about one-sixth of the head width at vertex, gradually widened to anterior margin, the two upper bristles on each orbit directed backward, the median bristles short, anterior one very long; arista plumose; palpi hardly dilated in male, rather distinctly dilated in female. Thorax with 2 + 4 dorsocentral bristles, the anterior pair of postsuturals small but distinct; scutellum rather elongate, bare on sides; sternopleurals 1 + 2. Abdomen elongate ovate; basal sternite bare. Fore femur with one or two short preapical anteroventral bristles, the mid and hind pairs in same sex with a series of closely placed, short, stout bristles or spines on apical third or more of the same surface; femora of female without these short bristles, the hind pair with two or three longer, preapical, anteroventral bristles; fore tibia without a median posterior bristle; mid tibia with two posterior bristles; hind tibia with one anterodorsal and one anteroventral bristle. Fourth wing vein hardly curved forward apically.

Length, 7.5 to 9 millimeters.

Type, allotype female, and four female paratypes, Mount Maquiling, Laguna Province, Luzon (*Baker*); paratypes, two females, Fort de Knock, Sumatra, 1925 (*Jacobson*); males, Tandjunggadang, Sumatra (*Jacobson*); Peradenyia, Ceylon (*E. E. Greene*); Singapore (*Baker*); Siam, Sungkie (*H. C. Robinson and N. Annandale*); Pahang, Federated Malay States, December 5, 1921 (*H. M. Pendlebury*).

Eumyiospila contraria Walker.

Very similar to the foregoing species, differing essentially as stated in the above synopsis. Usually the anterior pair of postsutural dorsocentrals is even less developed than in the last species.

Localities, Mount Maquiling and Mount Banahao, Luzon; Surigao, Surigao Province, Mindanao (*Baker*).

Hebecnema nigrithorax Stein.

This species and the next have the characters of *Hebecnema*, except that there are one or two weak setulæ at the base of third wing vein as in *Mydaea* and the preceding genus. The rather protuberant frons at bases of the antennæ, with the lack of parafacials when the head is seen from the side, coupled with the long plumose arista, and the thoracic chætotaxy, are sufficient to justify their retention in *Hebecnema*.

The general color of *nigrithorax* is fuscous, with the base of arista, almost entire abdomen, and the tibiæ tawny yellow. The calyptræ and halteres are brown, and the wings evenly smoky.

The eye facets in male become gradually larger on the upper portion of eyes. Thorax with 2 + 4 dorsocentrals. Fore tibia without a median posterior bristle; mid tibia with two posterior bristles; hind femur with four or five preapical anteroventral bristles, the posteroventral surface bare; hind tibia with one anterodorsal and one anteroventral bristle.

The female has the frons at vertex about one-fourth of the head width, widened anteriorly, and each orbit with three anterior incurved bristles, and two upper bristles backwardly curved. The humeri are yellowish, and the abdomen fuscous except at base.

Length, 3.5 millimeters.

Many specimens from Los Baños and Mount Maquiling, Laguna Province, Luzon (*Baker*).

Hebecnema luzonensis sp. nov.

Male.—Black, shining. Arista yellowish basally, face and cheeks with whitish dusting. Thorax with brownish dusting, but not noticeably vittate. Abdomen when seen from the rear with brownish dusting and two pairs of elongate, black, submedian spots, one on second and the other on third tergite. Legs pitchy black, the tibiæ and tarsi more yellowish brown. Wings brownish. Calyptræ and halteres dark brown.

Eyes as in the last species, but the facets not so large above and while, as in that species, there are two pairs of orbital bristles in front, the width of the frons is at middle about equal in width to the third antennal segment and not a mere line, as in *nigrithorax*. The bristling of the thorax and legs is as in that species except that there are two or three long bristles at middle of posteroventral surface of hind femur.

Length, 3.5 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

Genus **PICTIA** novum

Generic characters.—Frons in male about one-sixth of the head width, vertical and postvertical bristles of equal length, not half as long as the forwardly directed ocellar pair, orbits narrow, each with some inwardly directed bristles which become longer anteriorly; face slightly foveolate below base of each antenna, the upper central part therefore with a rather sharp carina; antennæ elongate; arista plumose; facial ridges with a series of microscopic hairs below; proboscis rather stout. Thorax as in *Helina*, but the prosternum haired on sides. Abdomen with rather strong bristles on apices of tergites. Legs and wings as in *Helina*, but the fourth vein with a very slight bend forward near apex.

Genotype, *Spilogaster xanthoceros* Walker.

Pictia xanthoceros Walker.

Head black, with white dusting, third antennal segment bright yellow. Thorax black, with conspicuous white-dusted markings, the dorsum when seen from behind with two black marks in front of suture on the lines of dorsocentrals, a broad transverse band behind suture, and the scutellum black; pleura with a broad, median, white, vertical mark. Abdomen black, narrowly yellowish on apices of tergites, second and third tergites each with a white-dusted basal fascia which is narrowly interrupted with black in middle, fourth tergite with only a narrow black central line, the broad black apical fascia of the other tergites absent. Legs black, tibiæ brownish. Wings hyaline, yellowish at bases and along costa. Calyptræ yellow. Halteres yellow with fuscous knobs.

Dorsocentral bristles 2 + 3, anterior presutural pair short; only one postsutural intraalar present; prealar short; sternopleurals three; hypopleura with hairs on lower posterior part, and quite noticeable hairs along the lower margin of the spiracle; scutellum bare on sides and below. Basal abdominal sternite haired. Fore tibia without a median posterior bristle; tarsi slender, longer than tibiæ; mid tibia with two posterior bristles; hind femur in male with short, fine, anteroventral bristles and a rather strong, short, posteroventral bristle about one-fourth from apex; hind tibia with a very fine short setula in the position of the calcar of *Phaonia* and its allies, and two or three short, fine anteroventral bristles.

Length, 8 millimeters.

Locality, Los Baños, Laguna Province, Luzon (*Baker*).

I have seen this species also from Sumatra.

Genus **PHAOMUSCA** novum

Generic characters.—Similar to *Polietes,* having the prosternum and upper margin of hypopleura in front of spiracle hairy, and the hind tibia with a bristle well beyond the middle on posterodorsal surface. The eyes are but sparsely hairy, the thorax has only one pair of acrostichals, the prescutellar pair, the pteropleura is bare, and the facial ridges are bare except near lower margin. Third wing vein bare at base, fourth not curved forward at apex. Belongs to the same group as *Phaonia* and its allies.

Genotype, the following species.

Phaomusca bakeri sp. nov.

Male.—Black, densely grayish dusted. Antennæ and palpi orange yellow, the latter infuscated basally. Thorax when seen from behind with four narrow dark brown vittæ; scutellum with a large brown mark centrally; humeri yellowish. Dorsum of abdomen deep black on disk of basal three visible tergites, merging into brown laterally, and not extending to sides; fourth tergite lead gray, slightly brownish at base, and narrowly rufous at apex. Legs rufous, fore coxæ, bases of hind femora, and the tarsi a little darker. Wings strongly tinged with yellow, veins yellow, darker apically. Calyptræ yellowish. Halteres brownish.

Eyes sparsely haired; frons linear above, orbits setulose on anterior half; parafacials in profile linear; cheek higher than width of third antennal segment, the latter about four times as long as second; arista plumose; palpi rather stout, their bristles short. Dorsocentrals 2 + 4; both postsutural intraalars long; prealar long; scutellum bare on sides and below; sternopleurals 1 + 2. Abdomen broadly ovate, basal sternite bare; all tergites with long sparse bristles on posterior margins and laterally at middle. Fore tibia without a median posterior bristle; mid femur with a few posteroventral bristles basally; mid tibia with three posterior bristles; hind femur with a series of short, fine, anteroventral bristles that become longer apically; hind tibia with two anterodorsal and three or four fine anteroventral bristles, the posterodorsal calcar short.

Length, 7.5 millimeters.

Type, Mount Banahao, Luzon (*Baker*).

Atherigona seticauda sp. nov.

Male.—Head black, orbits, frontal triangle, sides of occiput, and the entire face and cheeks densely gray dusted; interfrontalia dark brown, reddish in front; antennæ and palpi black; arista brown. Thorax black, densely gray dusted, dorsum with three rather faint dark vittæ; humeri slightly yellowish, obscured by the dusting. Abdomen testaceous yellow, sides of the rudimentary first tergite with a fuscous mark which extends over anterior part of second also, the second with a pair of large, subtriangular, dark, discal marks, third with a pair of large, oblong, fuscous marks on disk which extend almost the entire length of tergite, fourth with a pair of smaller brown marks, third and fourth tergites each with a pale brown central stripe, the dorsum with gray dusting between and laterad of the dark markings. Legs testaceous yellow, almost the entire fore femora, basal halves of mid and hind femora, apical two-thirds of fore tibiæ, and fore tarsi except the apical segment, black; hind tibiæ apically and hind tarsi basally darkened. Wings hyaline. Calyptræ and halteres whitish.

Head normal; second segment of arista about three times as long as thick, third tapered, microscopically pubescent; palpi long and rather slender, the basal bristles weak, apical hairs soft and curled. Thorax normal. Second and third abdominal tergites equally long, the third meeting on venter apically, fifth tergite with a pair of long slender divergent discal bristles which are as long as third tergite, and also with a slight transverse apical ridge in front of which the disk is slightly hollowed out, but there is no prominent chitinized protuberance; below the level of the base of hypopygial forceps there is a long bristle on each side similar to the one on fifth tergite, but the exact situation of these is impossible to decide except by dissection, a course not permissible with a single type that is distinguished by such outstanding structural characters as this one. Fore femur as in *varia* Meigen; fore tarsus as long as fore tibia, second segment with some erect hairs below, those at base longest and about as long as the segment; hind femur without preapical anteroventral bristle; hind tibia with a short, stout, sharp pointed apical bristle on posterior side. Inner cross vein a little beyond middle of discal cell; first posterior cell a little narrowed apically.

Length, 3.5 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

No other species of the genus known to me has two pairs of long, backwardly directed bristles on the apical abdominal segments, and such a slight elevation of the fifth tergite.

Genus **XENOSINA** Malloch

I published a key to the species of this genus in 1925.[1] The new species described herein runs to *pudica* var. *rufomarginata* Malloch, but is much paler, with the presutural and anterior two pairs of postsutural dorsocentrals conspicuously shorter than the prescutellar pairs, not as long as those in *rufomarginata,* the apical bristles on third and fourth visible abdominal tergites are short and fine, whereas in the old species they are long and strong, and there is no transverse series of discal bristles on the fourth tergite in *siamensis.*

Xenosina siamensis sp. nov.

Female.—Head testaceous; frons black, with gray dusting; parafacials except at upper extremity, and the cheeks except at anterior margins, fuscous; occiput grayish, with a pale dusting; antennæ yellow; palpi brown. Thorax reddish testaceous, with grayish dusting, dorsum with four brownish vittæ. Abdomen reddish testaceous, shining. Legs concolorous with abdomen. Wings yellowish hyaline. Calyptræ and halteres concolorous with abdomen.

Head as in allied species. Only the two prescutellar pairs of dorsocentrals long and strong, the others (anterior intraalar, and prealar) short and rather weak; scutellum bare on sides, one setula below near apex in type; hypopleura with a few microscopic hairs on lower posterior angle; some black setulose hairs along lower margin of metapleural spiracle which character is not found in any other species of the genus. Abdomen ovate, with some hairs on basal sternite which are normally absent in the genus, and no strong tergal bristles. Legs except the hind pair missing in type; hind femur with three or four preapical anteroventral bristles and one or two fine hairs near base on posteroventral surface; hind tibia with one anterodorsal and about four anteroventral bristles. Wing normal.

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[1] Philip. Journ. Sci. 26 (1925) 509.

Length, 7.5 millimeters.

Type, Biserat, Siam (*Robinson and Annandale*). [British Museum.]

MUSCINÆ

Genus **BRYANTINA** novum

Generic characters.—Apparently most closely related to *Graphomyia* Robineau-Desvoidy. Head higher than long, frons fully one-third of the head width in male, fully twice as wide as long at center, a little longer on sides, the orbits slightly differentiated, each with two bristles, the anterior one incurved, situated near front margin; ocellar, postvertical, and vertical bristles long, the postverticals widely divergent; face deeply excavated, with a slight central vertical carina; antennæ elongate, third segment covered with conspicuous pale down, and about eight times as long as second segment; second segment of arista much elongated, third widened in middle, long-haired on upper side from near base to apex, on underside only on apical fifth. Thorax with 2 + 4 dorsocentrals, one postsutural intraalar, one pair of prescutellar acrostichals, and a strong prealar; prosternum, propleura in center, pteropleura, hypopleura, and postalar declivity bare, fourth vein broadly curved forward beyond middle, the veins all bare. Abdomen robust. Legs slender. Lower calypter broad, subtransverse at apex.

Genotype, the following species.

Bryantina javensis sp. nov.

Male.—Head testaceous, upper occiput, frons, and face cinnamon brown, the vibrissal angles blackish; antennæ brown, third segment black, arista brown basally, black apically, the hairs black; palpi and proboscis testaceous, the latter dark at apex. Thorax testaceous, dorsum, including scutellum and postnotum, broadly black on disk, the mesonotum with lateral margins and two broad vittæ along lines of dorsocentrals white dusted, the white dust carried across in front of scutellum and connecting the submedian vittæ; a brown spot on middle of hind margin of mesopleura and another on sternopleura. Abdomen testaceous, with large transverse black marks on apical four visible tergites. Legs testaceous, tarsi black. Wings hyaline, costal vein yellow at base, dark beyond humeral cross vein, a dark patch near apex of submarginal cell and another near apex of first posterior cell due to the presence of dense, dark, microscopic hairs. Calyptræ yellow, a blackish spot on upper one near base. Halteres yellow.

Eyes sparsely hairy; second segment of arista fully six times as long as thick; cheek higher than width of third antennal segment; palpi tapered apically; proboscis slender, labellæ normal. Sternopleura with one fine bristle. First visible tergite occupying about one half the area of dorsum of abdomen, slightly concave in posterior outline, the next three tergites widest at middle, tapered laterally; basal two sternites with a conspicuous group of short black setulose hairs on each side of hind margin, the succeeding sternites less noticeably setulose, fifth with a shallow, broad, apical, rounded emargination; hypopygium small. Fore femur with a complete series of posteroventral bristles; fore tibia without a median posterior bristle; mid tibia with a short posterior bristle; hind femur without evident ventral bristles; hind tibia with one anterodorsal and anteroventral, both very short. Costal vein thickened beyond humeral break, tapered to auxiliary vein; third vein slightly arcuate apically.

Length, 5 millimeters.

Type, Tjibodas, Mount Gede, Java, 4,500 feet, 1909 (*Bryant and Palmer*).

Named in honor of the first-named collector. Type in United States National Museum.

The genus is one of the most remarkable of the genera in the subfamily; the strikingly distinct structure of the head and the absence of hairs on the base of arista are sufficient to distinguish it from any other in the male sex, which is the only one known to me at this time.

TACHINIDÆ

Genus **CYLINDROMYIELLA** novum

Generic characters.—This genus differs from *Cylindromyia* Meigen in having the palpi large and rather broad, and the first posterior cell of wing widely open, the venation being similar to that of many Phaoniinæ with the fourth vein very little forwardly inclined apically, not more than the third vein deflected apically. Despite the phaonine venation, this is a true tachinid, with much the same appearance as a *Cylindromyia.* Like that genus, it has the vertical part of thorax below base of abdomen and above hind coxæ heavily chitinized and slightly convex, its extent being about equal to that of metanotum below postscutellum. Vertex with a pair of strong inner bristles, the others minute or absent; ocellars small, divergent; frons in male about one-fourth of the head width, orbits narrower than interfrontalia, with only incurved inner marginal bristles; parafacials almost indistinguishable from the side; antennæ elongate; arista bare; proboscis short. Prosternum, and propleura centrally, bare; mesopleura with two or three bristles on upper third of hind margin; anterior sternopleural absent, the other two present; hypopleural bristles long. Abdomen subcylindrical, with bristles on sides of tergites, central apical bristles present only on first visible tergite. Inner cross vein a little before apex of first vein and slightly beyond middle of discal cell; outer cross vein at less than its own length from apex of fifth.

Genotype, the following species.

Cylindromyiella bakeri sp. nov.

Male.—Head blackish brown, densely gray dusted, antennæ dark brown, apex of second and base of third segment reddish; palpi dark brown. Thorax glossy black on disk, the sides of mesonotum, and the pleura gray dusted. Abdomen glossy honey yellow, becoming blackish apically. Legs shining brown. Wings grayish hyaline. Calyptræ white. Halteres yellow.

Eye facets enlarged slightly in front; cheek not as wide as the rather wide third antennal segment; palpi nearly bare. Dorsocentrals weak and short; presutural acrostichals weak, two-rowed; scutellum convex, with four bristles and many hairs. Tergites becoming shorter apically, the bristles on sides stout and of moderate length on first and second tergites, those on sides of third, and some of those on second short and rather stubby, one long bristle at base on each side of third. Hypopygium with a pair of short, sharp, slightly curved forceps. Femora rather stout, each with some sparse, moderately long bristles on basal half, and a series of short spines on apical half of anteroventral and posteroventral surfaces; fore and mid tibiæ without evident bristles at middle, hind tibia with one anteroventral, one posterodorsal, and two anterodorsal bristles, all short.

Length, 3.25 millimeters.

Type, Surigao, Surigao Province, Mindanao (*Baker*).

Genus **THRYPTODEXIA** novum

Generic characters.—A peculiar genus, with the habitus of a thryptocerine and the plumose arista of a dexiine. Frons at vertex about one-fifth of the head width, gradually widened to anterior margin, each orbit about as wide as interfrontalia, with four supraorbitals, the upper curved backward, second curved forward, third inward, and anterior pair curved forward, the three or four infraorbitals all curved inward; all four verticals long, postverticals short and weak; ocellars but little stronger than the postverticals; orbitals ceasing at base of antennæ; some short setulæ above each of the vibrissæ, the latter long; antennæ almost as long as the face, the latter shallowly concave, not carinate centrally; proboscis short and stout; palpi normal. Thoracic bristles moderately strong; sternopleurals 1 + 1; postscutellum well developed; type specimen pinned so that it is impossible to see the prosternum. Abdomen narrowly ovate, with apical bristles on tergites 2 to 4. Mid tibia with a median ventral bristle. First posterior cell ending in tip of wing, narrowly open, bend of fourth vein obtuse; inner cross vein close to middle of discal cell and a little proximad of apex of first vein; outer cross vein at about its own length from apex of fifth vein.

Genotype, the following species.

Thryptodexia polita sp. nov.

Female.—Glossy black, orbits and dorsum of thorax gray dusted. Antennæ and palpi luteous. Legs more brownish than body. Wings yellowish hyaline. Calyptræ whitish. Knobs of halteres fuscous.

Orbits and parafacials without hairs; longest hairs on arista as long as width of third antennal segment, length of latter over three times that of second segment. Presutural acrostichals, two pairs; postsutural dorsocentrals, four pairs. Fore tibia with a median posterior bristle; fore tarsus slender; femora sparsely bristled and rather stout.

Length, 4 millimeters.

Type, Los Baños, Laguna Province, Luzon (*Baker*).

Actia apicipunctata sp. nov.

Male.—Head testaceous, grayish yellow dusted, upper occiput fuscous; antennæ and palpi fuscous; palpi yellow. Thorax black, gray dusted, not vittate. Abdomen yellowish, semipellucid, apices of tergites, most of third and all of fourth fuscous, dorsum gray dusted. Legs testaceous yellow, bases of fore femora, apices of mid and hind pairs and of tarsi darkened. Wings hyaline, with a large fuscous spot extending from before apex of second vein to tip of wing and spreading over anterior half of tip of first posterior cell. Lower calypter brown on disk. Halteres yellow.

Frons normal; anterior orbital bristles extending below bases of antennæ; third antennal segment very large, as wide as widest part of eye; arista pubescent, second segment over four times as long as thick. Apical three tergites with marginal bristles. Legs normal. First wing vein setulose at apex above and below, third setulose at base below and on most of its length above; fifth bare; inner cross vein a little before middle of discal cell and apex of first vein; outer cross vein at about its own length from apex of fifth vein.

Length, 4.5 millimeters.

Type, Baguio, Benguet Subprovince, Luzon (*Baker*).

Genus **MALAYIA** novum

Generic characters.—Belongs to the group in Tachinidæ in which the first posterior cell is open and ends in the exact wing tip. Inner vertical bristles long, a pair of short incurved postverticals directly in line behind them, the outer verticals short; ocellars present, divergent; anterior supraorbital directed forward; the fine lateral hairs descending in a series along inner margin of parafacial to middle of latter, at which point they begin to parallel or intermingle with those on lower half of facial ridge; face in type slightly transversely elevated on upper half, but this may be due to distortion, as the specimen is slightly immature; arista bare, second segment about as long as thick; third antennal segment about three times as long as second, and with a series of short fine setulæ along its outer edge; proboscis short and stout; palpi apparently present in type, but it is impossible to distinguish them clearly. Prosternum bare; sternopleurals 1 + 1; hypopleurals fine; postscutellum small but distinct. Abdomen with apical bristles on tergites 1 to 4. Inner cross vein about one-third from apex of discal cell and distinctly beyond apex of first vein; bend of fourth vein about four-sevenths from outer cross vein to tip, from which point it runs diagonally forward to tip (fig. 1).

Genotype, the following species.

Malayia fuscinervis sp. nov.

Female.—Shining black. Interfrontalia brown, whitish dusted; antennæ black, reddish at base of third segment. Thorax gray dusted, most distinctly so on sides of mesonotum, and with two narrow black vittæ between dorsocentrals and acrostichals in front of suture. A rather conspicuous fascia of white dust at base of second tergite. Legs black. Wings grayish hyaline, marked with fuscous, as in fig. 1. Calyptræ white. Halteres black.

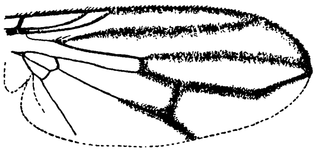

FIG. 1. *Malayia fuscinervis* sp. nov., wing.

Frons at vertex about one-third of the head width, slightly widened anteriorly, each orbit as wide as interfrontalia, upper supraorbital distinctly in front of anterior ocellus, curved outward and backward, anterior one curved forward and situated close to level of the upper incurved infraorbital; arista rather thick; third antennal segment about four times as long as wide and fully three times as long as second; eyes narrowed below; cheek about one-third of eye height. Thorax with 2 + 3 dorsocentrals, and only hairlike acrostichals. Fore tibia with two anterodorsal and two posterior bristles; mid tibia with an anteroventral, one anterodorsal, and one posterodorsal bristle; hind tibia with two anterodorsal, anteroventral, and posterodorsal bristles. Calyptræ rather small, rounded at apices, clear of scutellum at base.

Length, 4.75 millimeters.

Type, Pahang, Camerons Highlands, Federated Malay States, 4,800 feet, at light, October 18, 1923 (*Pendlebury*).

The outstanding feature of this genus is the setulose anterior (upper) margin of the third antennal segment; some other genera have this segment downy or pilose, but no other one known to me has it setulose, as here.

Tribe PALPOSTOMINI

Although the acceptance of tribes in this family is accompanied by many difficulties there are some which appear to be fairly well distinguished, and amongst these is the Palpostomini. The character of the palpiform apical labellæ of the proboscis is a rather uncertain one to depend on, but the narrow, apically rounded, lower calypter, almost bare arista, approximation of the apex of first posterior cell to the tip of wing, and the setulose prosternum, taken in combination, readily distinguish the genera from those of other tribes.

Ochromeigenia ormioides Townsend.

Apparently a common and widely distributed species. I have seen it from China, Sumatra, Java, and the Federated Malay States. I have no doubt that it occurs in the Philippines.

ILLUSTRATION

TEXT FIGURE

FIG. 1. *Malayia fuscinervis* sp. nov., wing.

PHILIPPINE CRICKET-LOCUSTS (GRYLLACRIDÆ)

By H. H. Karny

Of Buitenzorg, Dutch East Indies

THREE PLATES

After having completed my paper on Philippine cricket-locusts (Gryllacridæ)[1] I received further material from Prof. C. F. Baker for determination. As was to be expected, the material contained several interesting specimens which are here presented.

VENATIONAL TYPE III (=IIIa)

Gryllacris plebeia Stål.

Gryllacris plebeia Stål, Karny, Philip. Journ. Sci. 28 (1925) 136.

Gryllacris plebeia subsp. immaculata Griffini. Plate 2, fig. 2.

Gryllacris plebeia subsp. *immaculata* Griffini, Karny, Philip. Journ. Sci. 28 (1925) 139.

One female from Mount Maquiling, Luzon (*Baker*); measurements intermediate between those of the female from Polillo and of that from Mount Maquiling. Tegminal venation practically as in Plate 10, fig. 2,[1] but the precostals very weak and indistinct; subcostal vein not simple, but simply forked before the end, the fork branches, however, much shorter than in fig. 3;[1] branches of R and Rs practically as in fig. 2,[1] but much less divergent; following veins all as in fig. 2.[1]

For shape of ovipositor see Plate 2, fig. 2.

Gryllacris isseli Griffini. Plate 3, fig. 1.

Gryllacris isseli Griffini, Ann. Mus. Nat. Hung. 11 (1913) 299, 303; Bruner, Univ. of Nebraska Stud. Lincoln No. 2, 15 (1915) 267; Griffini, Philip. Journ. Sci. § 10 (1915) 65, 69.

Gryllacris nigrogeniculata tristis Karny, Philip. Journ. Sci. 28 (1925) 148.

When describing my subsp. *tristis,* I had only one female before me, and I could not find any differences between it and the true *nigrogeniculata* other than color characters and a very slight difference in shape of ovipositor. Therefore, I believed it to be nothing but a mere color race of *nigrogeniculata,* and could not identify it with a different species. Now I have from Professor Baker a male from the same locality, which belongs without doubt to the same form as the *tristis* female. This male, however, differs from *nigrogeniculata,* not only in color characters, but also in the shape of the external genitalia (Plate 3, fig. 1) ; in fact, it differs so greatly that it must be regarded as a different species. On the other hand, it agrees fairly closely with *isseli* Griffini, the differences being only in individual characters. Therefore, *tristis* female must be placed with *isseli,* as it represents the hitherto unknown female of this Griffinian species.

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[1] Philip. Journ. Sci. 28 (1925) 131–171.

The venation of the male now before me is practically the same as in the female previously described;[2] the rich development of the medial vein, especially, agrees very well, on both tegmina, with that shown in fig. 2 (female).[2] The last and penultimate tergites, described by Griffini as "castaneum," are quite brownish black in the male before me. The genitalia also agree with Griffini's description, except that one of the two teeth of the ninth tergite is not obtected by the subgenital plate in the specimen before me; these teeth become castaneous distad. By comparing fig. 1 (Plate 3) given here with Plate 4, fig. 12,[2] of *nigrogeniculata,* it is evident that both are built according to the same type but show differences of specific value; the teeth of the ninth tergite, especially, are somewhat differently shaped in the two species, and the styles are shorter in *isseli,* more inserted outside, and directed outward.

Measurements of Gryllacris isseli Griffini.

Length.	Male. mm.
Body	25
Pronotum	6.4
Tegmina	20.4
Fore femora	8.6
Hind femora	15.6

The male before me is somewhat larger than Griffini's type specimen, and also a little larger than the female described as *tristis.*

One male from Samar, leg. *Baker.*

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[2] Philip. Journ. Sci. 28 (1925) 148, pl. 7, figs. 1 and 2.

VENATIONAL TYPE IIIb

Gryllacris cyanipes sp. nov. Plate 1, figs. 1 to 3.

A bright species. General color yellow-brown, with shining black markings.

Occiput strongly arched, brownish black, with a large yellow-brown H, the branches of which run forward against the fastigium, parallel with another one, and diverge backward strongly against the fore margin of the pronotum. From the upper angle of each eye runs a broad yellowish band above the antennal insertion mesad and forward, communicating with the anterior part of the H-branches; there is another, strongly impressed yellow band, from the upper angle of the eye against the hind margin of the head, along the sides of the occiput; close before the hind margin arises a rather perpendicular, but strongly S-curved, yellowish line, which runs on to the genæ. Fastigium of vertex nearly twice as broad as first antennal segment, blackish, blunt on either side, not keeled, and with a small, not well-defined, yellow ocellar spot, the color continued backward to the H-branches of occiput, forward into a short, oblique, mesad-directed, yellow-brown streak. Antennæ ferrugineous brown throughout, scrobes margined below and inside broadly black. Border between fastigia of vertex and of front broadly black. Frontal fastigium yellow-brown, with a very indistinct, small ocellar spot. Forehead shining, yellow-brown, depressed against the clypeus and becoming darker; on either side two impressed, circular, well-defined, black dots, arranged in a slightly oblique line which is about parallel to the lateral parts of frontoclypeal suture, and about as far from the latter as from another line. From the inner lower angle of scrobes runs an oblique black band mesad and downward, then suddenly obtusangularly curved downward and continuing perpendicularly to the inner, impressed dot. Subocular furrow strongly impressed, broadened downward, broadly black. Mouth parts of usual shape, dark castaneous, mandibles even darker along the inside. Palpi long, apical joints somewhat thickened distad, that of labial palpi obliquely truncate and distinctly excavate at apex, much less broadened than in the species of the *fumigata* and *fasciculata* groups. Genæ strongly arched, shining black, with the yellowish curved line coming from the occiput and broadly yellowish below and behind.

Pronotum longer than wide, with rounded fore and truncate hind margin, yellow-brown, broadly margined with black all around. Disk with a transverse furrow close behind fore margin, and another, strongly convex backward, before hind margin; both strongly impressed and broadly black. In the middle a rather narrow black band running throughout the whole length, and inclosing in its middle part a slight, short, longitudinal sulcus. Laterad from the fore end of this furrow is a large, slightly impressed, black spot from which issues forward a short black streak; backward and outward, apposed to it, is the fore angle of a large, oblique, black triangle, the rear angle of which reaches the hind sulcus, and the lower angle is situated at the communication of the hind branch of the V-sulcus with the oblique hind sulcus of the lateral lobes. These furrows are both strongly impressed, broadly black, the spaces between them and against the margins strongly arched. The black color of the V-sulcus is connected at its lower angle with the black of the margin, that of the oblique hind sulcus is also continued into the marginal black; above it is a second black band at the sides of the discal metazona, running from the large black triangle to the lateral angle of the truncate hind margin of the disk. Altogether, we have here a pronotal picture of the *signifera* type, but more melanistic; that is, the black markings are more expanded and are partly confluent with one another.

Organs of flight (Plate 1, figs. 1 and 2) distinctly reaching beyond the hind knees, but not or hardly the end of the abdomen. Venation according to type IIIb; that is, of the same type as in the Bornean *venosa.*[3] Tegmina whitish hyaline, with extraordinarily thick black longitudinal and cross veins; only the costal vein brownish yellow, but when approaching the fore margin gradually becoming darker, at least black too. Two precostals; at the end of the second one the fore margin is strongly excavated. Costa straight, at the excavation approximating close to the fore margin and reaching it then about in its middle. None of the tegminal fields unusually broadened, all of about the same width. Subcosta bifurcate close before the end, reaching the fore margin about at the beginning of the apical third. Radial sector originating from radial vein about in the middle of tegmen, furcated into three branches, the two apical ones extraordinarily short; radial vein itself bifurcate close before the end. Medial and cubital veins with a rather long, common stem which furcates into these two chief veins about at the end of basal fourth of tegminal length. Medial vein itself again bifurcate on the left tegmen in the specimen before me, about in the middle of tegminal length, but the branches of the fork unite again, still before reaching the apical margin, while the medial vein of right tegmen remains simple throughout. Cubital vein remaining simple on both tegmina. Behind the common stem of medial and cubital veins a distinctly impressed anal fold is visible, indicating with certainty that the stem is indeed M + Cu and not M alone. Behind it five simple longitudinal veins, the last two with a very short, common stem.

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[3] Journ. F. M. S. Mus. 13 (1925) 25–27, fig. 11.

Hind wings grayish hyaline. Costa and subcosta and the cross veins between them brownish yellow, all other veins strong, blackish, but not as broadly black as in tegmina. Preanal field very narrow, as in *venosa.* Costal marginal. Subcostal vein running in a forward concave bow to the fore margin, which it reaches about in the middle. Following veins arranged according to the same type as in *venosa;* in the figure in my paper cited above,[3] the names of the veins must now be corrected from those given in my earlier paper.[4] The vein indicated in the Journal of the Federated Malay States Museum, fig. 11, as Rs, will be in fact Rs + M; M should be changed to Cu, and Cu will represent CuS. A definite decision on this point will be impossible, however, before the larval wing cases of the *venosa* type have been studied—a study which it will not be possible to make in the near future because of the extraordinary rarity of specimens belonging to this type. Radial vein simply forked before apex, reaching the fore margin about at the beginning of its apical fourth. This vein sends forth, close before the middle, a short oblique cross vein (probably base of Rs + M, as I have indicated in Plate 1, fig. 2) which communicates with the longitudinal vein behind it (probably Cu) for a very short distance (much shorter than in *venosa*); then, after leaving that longitudinal vein, again simply forked distad (probably into Rs and M). The following two longitudinal veins (probably Cu and CuS) with a short common stem, simple throughout. Anal fan large, anal veins numerous.

Legs very stout, comparatively short. Coxæ yellow-brown, marked with shining black, fore coxæ shining black nearly throughout. All femora and tibiæ shining black throughout, with a bright steel blue splendor. Fore and middle tibiæ with four pairs of moderately long, movable spines of the same black color as the tibiæ, but becoming yellowish at the tips. Hind femora very thick, with five to eight strong spines outside, twelve inside. Hind tibiæ unarmed below (except the apical spurs); above complanate and armed with four or five strong spines outside, three or four inside, except the apical spines. All tarsi pale brownish yellow throughout, claws black.

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[4] Zeitschr. wiss Zool. 25 (1925) 35–54.

Abdomen brownish yellow above and laterad, blackish below. Cerci yellow-brown, about one-third the length of the ovipositor. Subgenital plate (Plate 1, fig. 3) triangular, angulately excised at apex. Ovipositor moderately upcurved, gradually tapering to the tip, which is rather acute.

Measurements of Gryllacris cyanipes sp. nov.

Length.	Female. mm.
Body	36.3
Pronotum	9.0
Tegmina	27.0
Fore femora	9.7
Hind femora	17.5
Ovipositor	17.0

One female from Samar (*Baker*).

This new species is without doubt closely related with the Bornean *venosa,* the only species hitherto known to represent the same type of venation. *Gryllacris cyanipes* differs, however, from *venosa* by the shining black markings of head and pronotum, by the different shape of the female subgenital plate, and especially by the bright steel blue femora and tibiæ of all legs, which contrast strongly with the pale, yellowish tarsi.

Griffini[5] compared with *venosa* the following species: *primigenii* from Luzon, *la-baumei* from Lombok, *grassii* from Borneo, and *martha* from Annam. I have had occasion to study only *grassii,* and found it to differ widely from *venosa* and *cyanipes,* its venation being according to type II.[6] Of the three others, it is not possible to say whether they agree in venation with *grassii* or with *venosa* and *cyanipes.* If any conclusion can be drawn from the length of the hind femora, it should be expected that *primi-genii* and *martha* are more closely related with *grassii,* while the length of the tegmina would place *martha* also much nearer to *grassii* than to *venosa* and *cyanipes.* On the other hand, *la-baumei* should perhaps be placed nearer to *venosa* and *cyanipes,* if it is not related with the *horváthi* and *personata* groups and thus representing type IV. These points cannot be definitely determined until the venation of all these species shall have been studied. At all events, *cyanipes* differs from all of these species at first view by the very distinctive color of the legs.

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[5] Mon. Zool. It. 29 (1918) 28.

[6] Treubia 5, Livr. 1–3 (1924) 68, fig. 27.

VENATIONAL TYPE V

Gryllacris recticauda Karny.

Gryllacris recticauda KARNY, Philip. Journ. Sci. 28 (1925) 152.

Gryllacris recticauda subsp. **ochropis** subsp. nov. Plate 2, figs. 1 and 4; Plate 3, fig. 5.

Very near in size and appearance to the typical form, but the general color somewhat paler, more yellow-brown. Head quite pale, concolorous, except the black eyes, and the labrum which is yellowish in the middle, broadly blackish brown laterad and below. Ocellar spots small, yellow, indistinct. First antennal segment infuscated at apex, second basad and distad, others concolorous, ferrugineous.

Pronotum as in typical *recticauda*. Tegmina also practically as in that form, the venation, however, somewhat different, but this may perhaps be a mere individual variation (Plate 3, fig. 5). Costal area somewhat wider. Radial sector on left tegmen simple, arising from radial vein more basad, close behind the middle of the tegminal length, therefore before the first fore branch of the radial vein; on right tegmen practically as in typical *recticauda*,[7] but the apex of the radial vein, after emitting the sector, simple, not forked again. Medial vein on both tegmina coalescent with cubitus at the very base only, thus practically free, further simple, not forked as in the typical form. Cubital vein distinctly furcate before the middle on both tegmina. Following veins as in typical *recticauda*, but the last anal more abortive, on left tegmen (Plate 3, fig. 5) even more than on right. Hind wings practically as in the typical form.

Legs pale, testaceous, only the base of tibiæ black, on fore and middle legs for about 1.5 millimeters, on hind legs for 2⅓ millimeters; apex of hind femora somewhat infuscated. Spines of all legs as in the typical form, those on hind tibiæ black throughout and with a black spot apposed at their bases.

Ovipositor (Plate 2, fig. 1) as in typical *recticauda*, quite straight. Subgenital plate of female flattened, acuminate at apex, before it a short longitudinal keel and at the base of this a small, but deep, circular impression.

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[7] Philip. Journ. Sci. 28 (1925), pl. 2, fig. 5.

Measurements of Gryllacris recticauda subsp. ochropis subsp. nov.

Length.	Female. mm.
Body	21.8
Pronotum	4.7
Tegmina	14.3
Fore femora	7.7
Hind femora	14.5
Ovipositor	14.5

One female from Mount Maquiling, Luzon (*Baker*).

There is no doubt that we have here a form supplying quite the same type in Luzon as that represented in Mindanao by typical *recticauda*. The question is only whether *ochropis* should be considered a mere local race or a separate species. The general appearance is very near to typical *recticauda* and the differences consist in mere color characters; on the other hand, the shape of the subgenital plate of the female is so different that it should be perhaps expected that the males, when they become known, will also show valuable differences in the shape of the external genitalia. Then it would perhaps become necessary to consider *recticauda* and *ochropis* as different species, but this question cannot be definitely decided until further material (especially males) of both can be studied. It is a very regrettable fact that nearly all the species and subspecies of *Gryllacris* are represented in Professor Baker's collection by one specimen only, so that it is practically impossible to give entirely satisfactory descriptions; therefore, many important systematic problems must remain undecided for the present.

Gryllacris recticauda subsp. **ochrocnemis** subsp. nov. Plate 1, figs. 4 and 5; Plate 3, fig. 3.

Very similar to typical *recticauda*, but somewhat larger and paler. Color of head much as in the typical form. The pronotum, too, offers no usable difference.

Tegmina larger and especially broader than in typical *recticauda*, the venation, however, according to the same type (Plate 1, figs. 4 and 5). Radial sector arising from radial vein on right tegmen before the middle three-branched, while the radial vein itself is simply forked; on left tegmen radial sector and radial vein grown together throughout, this R + Rs being five-branched, forward pectinate. Medial and cubital veins with a short but distinct common stem, the former simple on right tegmen, furcate before the middle on left tegmen, the latter simple on both. Following veins practically as in typical *recticauda,* as is also the case with the venation of the hind wings.

Legs pale throughout, brownish yellow, only the hind femora slightly infuscated at the very extreme tip. Spines as in the typical form, seven to nine on the hind femora outside. Left hind tibia with six spines outside, seven inside, right with seven outside, six inside. All spines of hind legs pale basad, blackish at their tips.

Apical tergite of male (Plate 3, fig. 3) enlarged, with a broad, shallow longitudinal furrow; produced at apex in two very small, acute, straight, crossed spines, which are black at the tips. Subgenital plate strongly transverse, very short; apical margin emarginate with broadly rounded lobes. Styles lateral, very short and thick.

Measurements of Gryllacris recticauda subsp. ochrocnemis subsp. nov.

Length.	Male. mm.
Body	21.0
Pronotum	5.6
Tegmina	17.5
Fore femora	7.6
Hind femora	14.7

One male from Samar (*Baker*).

Thus, *ochrocnemis* represents the *recticauda* type on Samar; it is distinguished from both *ochropis* and typical *recticauda* by the rather pale tibiæ, from *ochropis* by the color of forehead which is the same as in typical *recticauda.* As with the preceding form, nothing can be stated with regard to the systematic rank until males of *recticauda* and *ochropis* and females of *ochrocnemis* are known. The great similarity between *ochrocnemis* and *recticauda* would suggest that the male sexual organs of the latter will be found to be shaped according to the same type as in *ochrocnemis,* but no definite statement can be made on this point until the males of *recticauda* have been studied.

Gryllacris patellaris sp. nov. Plate 2, figs. 3 and 5; Plate 3, fig. 4.

A small species. General color ferrugineous. Antennæ ferrugineous yellow, first to third joints infuscated basad. Eyes dark, ovate, about twice as high as long. Fastigium of vertex somewhat narrower than first antennal joint, sharply keeled laterad. Both fastigia, margins of antennal scrobes, and the entire front dark brownish black. Ocellar spots very indistinct. Forehead much wider than high, smooth, with some very small, pin-pricklike dots, and under the magnifying glass very finely and densely rugulose. The blackish color of the forehead becomes gradually paler laterad, quite vanishing at the subocular sulcus; this distinct in its lower part (above the base of mandibles), shallow, triangular. Genæ brownish yellow. Clypeus dark above, gradually becoming pale yellow below. Labrum blackish. Mandibles ferrugineous. Palpi long and slender, the maxillary ones longer than the head is high, labial palpi hardly half as long. Apical joints somewhat thickened distad, those of the labial palpi much stronger than the maxillary ones; the former very obliquely truncate at apex, the latter transversely, both with strongly excavate apical area.

Pronotum brown, unicolorous; sculpture of disk very shallow, almost indistinct, while the V-shaped and the oblique hind sulci of the lateral lobes are strongly impressed, the areas between them strongly arched. Fore margin of disk roundly produced in the middle, hind margin roundly truncate. Lateral lobes trapezoidal, with rounded angles. No humeral sinus. Posthumeral tooth short and thick, directed horizontally backward.

Organs of flight shortened, hardly reaching beyond the hind knees and the apex of abdomen. Tegmina (Plate 3, fig. 4) ocherous, becoming paler and slightly more hyaline toward the tip, with somewhat darker ferrugineous veins. Three precostals. Costal vein slightly curved, forward convex, simple, reaching the fore margin distad from the middle. Costal area somewhat enlarged. Subcosta curvate, convex backward, simply forked close before the end, reaching the fore margin closely distad from the costal vein. Radial vein practically straight throughout, without a separate sector, diverging in the apical part into three (left tegmen) or four (right tegmen) branches, all of which reach the fore margin even before the apex. Medial vein free from base, nearly straight, touching the radial vein at one point about in the middle (left tegmen) or communicating with it for some distance distad from the middle (right tegmen), thus becoming by this communication actually a Rs + M, which is simply forked on right tegmen, and four-branched (backward pectinate) on left tegmen. Cubital vein exceedingly developed on both tegmina, forked before the middle, the fore branch then forked again about in the middle of the tegmen, the hind branch remaining simple. Following veins simple, four in all, first and second distinctly S-curved. Hind wing cycloid, grayish hyaline, with dark ferrugineous veins. The poor condition of the specimen does not permit description of the venation.

Legs stout, brownish yellow, all tibiæ paler than the femora, but blackish at the extreme base for about 1 millimeter on fore and middle legs, for 1.5 millimeters on hind legs. Femora not darkened at the tips. Fore and middle tibiæ with the usual four pairs of movable spines which are as long as or hardly longer than the tibia is broad, gradually becoming shorter distad. Hind femora very thick, with five to eight dark brown spinules outside, ten to twelve smaller ones inside. Hind tibiæ on each margin with six blackish spines and with a comparatively large shining black spot at the base of every spine. Tarsi pale, yellowish, claws black at tips only.

Ovipositor (Plate 2, fig. 3) strongly upcurved, short, broadest near base, gradually tapering to middle, from here to close before tip remaining nearly equally wide, at the tip somewhat obliquely truncate above. Subgenital plate of female rounded trapezoidal, with a large, ovate, transverse pit showing two small longitudinal lines (keels?) in its middle. At the border between subgenital plate and the preceding sternite, there is visible a small circular pit in the middle.

Measurements of Gryllacris patellaris sp. nov.

Length.	Female. mm.
Body	17.2
Pronotum	4.2
Tegmina	12.8
Fore femora	5.0
Hind femora	10.0
Ovipositor	8.0

One female from Mount Banahao (*Baker*).

In its small size the present insect somewhat resembles the species of the *punctifrons* group,[8] but differs from all of these at once by the color of the forehead. In this character, it agrees with *infumata,* a species I know from Brunner's description only. As Brunner says nothing about the shape of the fastigium or of the tegminal venation, I cannot decide whether the species are really related or not. At all events, *patellaris* differs from *infumata* by the much shorter ovipositor and by the different shape of the female subgenital plate. The dark forehead also somewhat resembles that of *recticauda;* but no large, yellow, lower ocellar spot is present in *patellaris* as there is in *recticauda;* further, the insect is smaller, the venation different, and the shape of the ovipositor quite different. By the same characters, *patellaris* may be distinguished also from *plebeia,* in which it would belong according to Griffini's key.[9]

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[8] Philip. Journ. Sci. 28 (1925) 154.

The arrangement of tegminal veins in the specimen before me is very curious and differs from all hitherto known *Gryllacris* venation. It may, however, be placed with type V, but cannot be identified with either Va, Vb, or Vc (= *Larnaca* type).[10] If the present specimen showed no abnormality (but the veins are arranged according to the same type on both tegmina!), it should be distinguished as a distinct subtype (Vd), characterized by the strongly developed cubital vein and, especially, by the basad free media communicating with the radial vein and then running farther as Rs + M, therefore without a separate radial sector. This coalition of Rs with M recalls somewhat type II,[11] of *plebeia connexa* [12] and of *chopardi;* [13] but in all these cases the base of the radial sector is developed as a distinct, oblique cross vein connecting the radial vein with the media, whereas in *patellaris* the latter vein communicates with the radius, not leaving even the extreme base of the radial sector free. Further material of this remarkable species is needed to show if this curious venational type is constant in this species.

Gryllacris longispina sp. nov. Plate 2, figs. 6 and 7; Plate 3, fig. 2.

A rather small species. Ferrugineous yellow, practically unicolorous. Head oblong, when seen in front. Eyes ovate, shining black. Fastigium of vertex somewhat wider than the first antennal joint, very bluntly keeled laterad, nearly rounded, about as in *recticauda.* Ocellar spots rather indistinct. Forehead smooth, set with a few long hairs, depressed below. Subocular sulcus distinct though shallow, slightly S-curved. Mouth parts concolorous, labrum only somewhat darkened. Pronotum rufous brown, somewhat nebulose; shape and sculpture practically as in the preceding species.

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[9] Philip. Journ. Sci. § D **10** (1915) 63–65.

[10] See Journ. F. M. S. Mus. **13** (1925) 45 ff.

[11] Treubia **5**, Livr. 1–3 (1924) 61.

[12] Philip. Journ. Sci. **28** (1925) 141.

[13] Treubia **9**, Beitr. 16 (1926).

Organs of flight reaching a little beyond the end of the abdomen, touching the hind knees. Tegmina (Plate 2, figs. 6 and 7) ferrugineous yellow, gradually becoming somewhat grayish hyaline before the tip. Veins ferrugineous yellow, arranged according to type Va. Two or three precostals. Costal vein simple, curved, forward convex, reaching the fore margin distad from the middle. Costal field broadened near its middle, tapering distad. Subcostal vein curved, backward convex, simple, reaching the fore margin at the beginning of the apical third. Radial vein curved forward, simple on right, simply forked on left tegmen. Radial sector arising from radial vein in the middle on left, distad from it on right tegmen, simply forked. Basad from radial sector there originates from radial vein the media, which is simply forked about in the middle of tegmen (left tegmen), or three-branched (on right tegmen). Cubital vein simple on both tegmina. All these chief veins show a certain tendency to obtusangulate deviations, thus forming some irregularly polygonous cells, especially in the distal part of tegmina. Behind the cubital vein there follow four simple longitudinal veins, the last two of which originate from a very short common stem.

Hind wings cycloid, hyaline, with yellowish longitudinal and dark brown cross veins. Costa marginal. Subcostal vein simple, curved forward, reaching the fore margin about in its middle. Radial vein practically straight, ending about at the tip of the wing, emitting two oblique cross branches against the fore margin. Cubital stem communicating with radius in basal part; from there originates a common stem (Rs + M + Cu), which emits after a short distance a simple longitudinal vein (Cu) ; then about in the middle of wing length a second one (M), at last bifurcate before the end (Rs), these forked branches about half as long as their stem.

Legs moderately long and rather stout, unicolorous. The movable spines (four pairs) on fore and middle tibiæ unusually long, the second somewhat more than twice as long as the tibia is wide, then decreasing in length distad.[14] Hind femora, too, of a similar shape as in that species,[15] with eight rather short spines outside, eleven or twelve inside. Spines of hind tibia unusually long, almost as long as the tibia is broad, directed obliquely backward, seven on each side. All spines of hind legs with blackish tips.

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[14] *Gryllacris arctatiformis*, Philip. Journ. Sci. 28 (1925) pl. 4, fig. 5.

[15] Op. cit., fig. 1.

End of male abdomen (Plate 3, fig. 2) concolorous. Eighth tergite enlarged, produced backward. Apical tergite perpendicular, with a median length sulcus and an evenly rounded general outline, but at the tip produced into two long spinelike processes, which are crossed and strongly produced horizontally laterad. Cerci rather short. Subgenital plate transverse, with reduced, nodiform styles.

Measurements of Gryllacris longispina sp. nov.

Length.	Male. mm.
Body	18.5
Pronotum	4.9
Tegmina	15.0
Fore femora	7.4
Hind femora	14.1

One male from Samar (*Baker*).

The new species in many respects resembles *plebeia immaculata*, with which it would be placed, according to Griffini's table (1915). It differs, however, by its tegminal venation and by the shape of the apical tergite, which are quite different. The former agrees with type Va, and no species of this type are yet known from the Philippine Islands. By this it recalls the Javanese *pallidula*, from which it differs, however, by the other characters, especially by the pale fastigia and by the apical tergite spines, which are much longer and stronger than in the Javanese species. The shape and armature of the legs recall *arctatiformis*, but the tegmina are much longer in the latter and represent a quite different venational type. Finally, there seems to be much resemblance to *solitaria*, but the male sexual characters show great differences, as described by Griffini (1918).

VENATIONAL TYPE IV

Gryllacris maculipennis bakeri Griffini.

Gryllacris maculipennis bakeri GRIFFINI, Atti Soc. It. Sci. Nat. 48 (1909) 81 (*maculipennis* var.); Rev. Suisse Zool. (1909) 390 (*maculipennis* var.); Atti Soc. It. Sci. Nat. 49 (1910) 14 (*maculipennis* var.); Philip. Journ. Sci. § D 10 (1915) 63, 67; Mon. Zool. It. 29 (1918) 23.

One female from Samar (*Baker*) agrees very well with Griffini's description (also in the shape and length of the ovipositor), but has the disk of the pronotum infuscated, especially along the fore and hind margins and along the sulci; lower part of lateral lobes pale yellowish. All femora have the outer lower carina blackish; the long movable spines of fore and middle tibiæ also grayish black, except at the tips, which are pale yellowish.

Gryllacris nasalis detersa Griffini.

Gryllacris nasalis detersa Griffini, KARNY, Philip. Journ. Sci. 28 (1925) 164.

One male from Los Baños (*Baker*) quite agrees with Griffini's description, but is conspicuously smaller.

Measurements of Gryllacris nasalis detersa Griffini.

Length.	Male. mm.
Body	25.0
Pronotum	5.8
Tegmina	25.0
Fore femora	8.4
Hind femora	14.7

The blackish labrum and the curious shape of the male apical tergite, described by Griffini in 1913, are very distinctive.

ILLUSTRATIONS

PLATE 1

FIGS. 1 to 3. *Gryllacris cyanipes* sp. nov., female; *1*, tegmen; *2*, fore part of hind wing; *3*, subgenital plate.

4 and 5. *Gryllacris recticauda ochrocnemis* subsp. nov., male; *4*, left tegmen; *5*, right tegmen.

PLATE 2

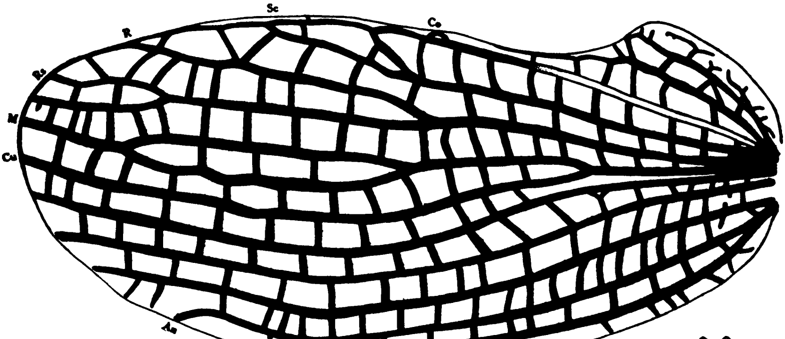
FIG. 1. *Gryllacris recticauda ochropis* subsp. nov., ovipositor, lateral view.

2. *Gryllacris plebeia immaculata* Griffini, ovipositor, lateral view.
3. *Gryllacris patellaris* sp. nov., ovipositor, lateral view.
4. *Gryllacris recticauda ochropis* subsp. nov., female, subgenital plate, ventral view.
5. *Gryllacris patellaris* sp. nov., female, subgenital plate, ventral view.
6. *Gryllacris longispina* sp. nov., male, venation of left tegmen.
7. *Gryllacris longispina* sp. nov., male, venation of right tegmen.

PLATE 3

FIG. 1. *Gryllacris isseli* Griffini, male, end of abdomen, ventral view.

2. *Gryllacris longispina* sp. nov., male, last tergite seen from behind.
3. *Gryllacris recticauda ochrocnemis* subsp. nov., male, end of abdomen, ventral view.
4. *Gryllacris patellaris* sp. nov., female, venation of right tegmen.
5. *Gryllacris recticauda ochropis* subsp. nov., female, venation of tegmen.



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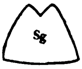

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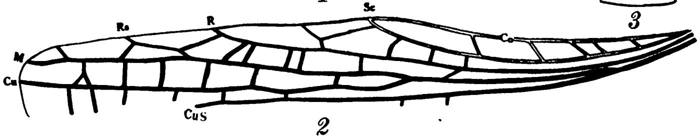

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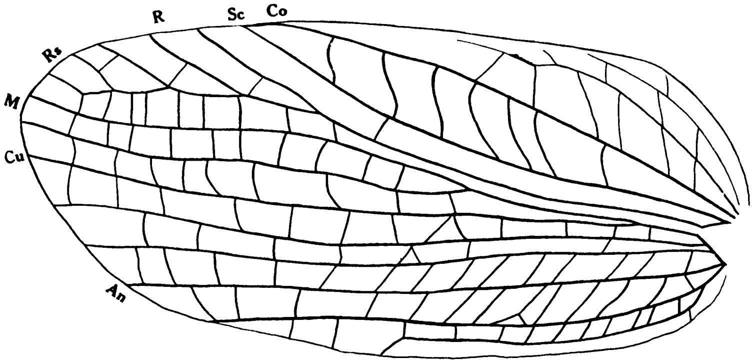

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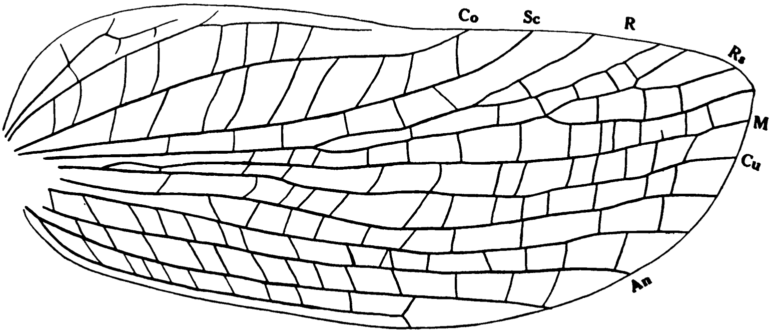

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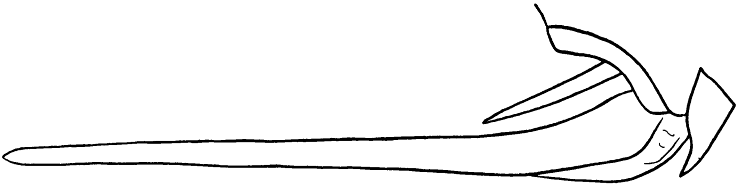
PLATE 1.



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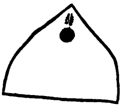

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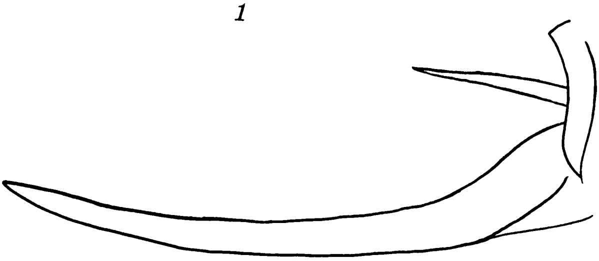

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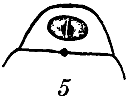

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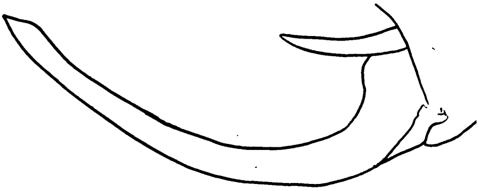

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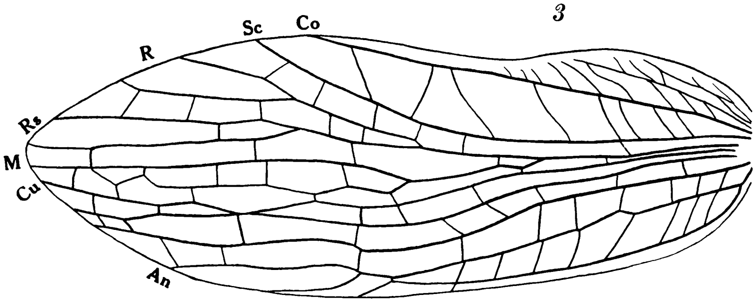

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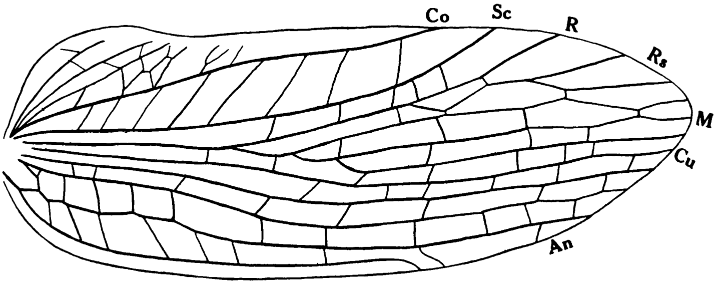

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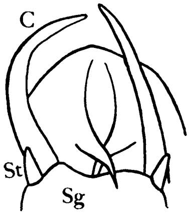
PLATE 2.



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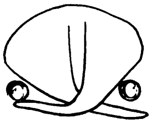

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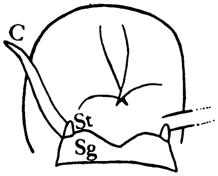

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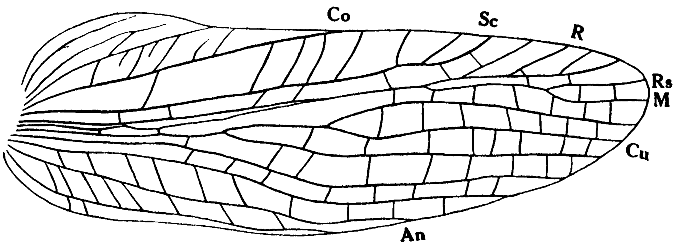

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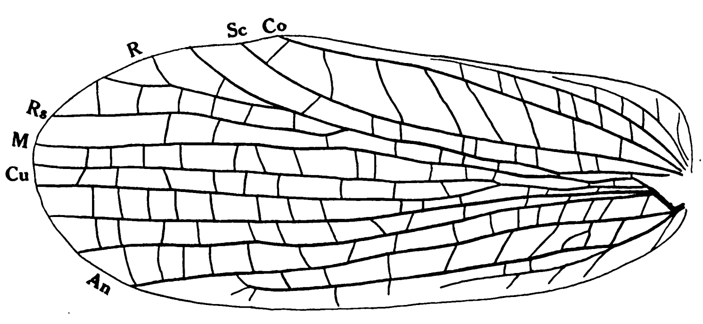

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PLATE 3.

FOUR NEW PHILIPPINE FISHES

By Albert W. Herre

Chief, Division of Fisheries, Bureau of Science, Manila

THREE PLATES

The family Balistidæ contains about fifty species of tropical reef and shore fishes, many of which attain a rather large size. They are of particular interest because some of them are dangerous to use as food, their flesh being more or less poisonous. I have given a detailed account of the Philippine balistids, or trigger fishes, in an earlier paper.[1] To the genera and species there described I am now able to add a new species belonging to a genus not previously known from the Philippines.

Key to the Philippine genera of Balistidæ.

a^1. Teeth white.
  b^1. Teeth uneven, oblique, more or less deeply notched.
    c^1. Caudal peduncle flattened dorsoventrally.......... **Abalistes.**
    c^2. Caudal peduncle flattened laterally.
      d^1. A groove in front of eye.
        e^1. Several enlarged bony plates behind gill openings.......... **Balistes.**
        e^2. Gill openings surrounded by ordinary scales.......... **Canthidermis.**
      d^2. No groove before eye.......... **Balistapus.**
  b^2. Teeth even, resembling incisors.......... **Melichthys.**
a^2. Teeth orange or red.......... **Odonus.**

Genus **CANTHIDERMIS** Swainson

Canthidermis Swainson, Nat. Hist. 2 (1839) 325.

This genus resembles *Balistes* in scalation except that there are no bony plates or enlarged scutes behind the gill openings; the thick rough scales do not overlap and may be comparatively smooth, or there may be several to many rows each with a spine or keel, especially on the caudal peduncle, which is laterally compressed like the body; the body is more elongate than in *Balistes;* the cheeks are completely scaled, with a deep, rather short groove before each eye; dorsal spines three, fitting closely into a deep groove when depressed, the first one very large;

---

[1] Philip. Journ. Sci. 25 (1924) 422–449.

the soft dorsal and anal much elevated anteriorly; the pelvic flap comparatively small, with a blunt, immovable spine.

Species few; intertropical, south to the Cape of Good Hope, north to Japan.

Canthidermis viola sp. nov.

Dorsal III–III–23; anal III–20; there are 42 scales from the upper angle of the gill opening to the end of the vertebral column, with 3 or 4 more scales extending upon the caudal fin, and 29 scales in a transverse series from the origin of the second dorsal to the vent.

The elongate body much compressed laterally, its depth 2.96 times in the length; the head elongate, the dorsal and ventral profiles about equally convex, wider than the body, 3.4 times in the length; the snout 1.65 times in the head; the eyes circular, high up, 4.7 times in the head, 2.85 times in the snout; the interorbital space angulate, keeled, 1.85 times the eye and a little more than 2.5 times in the head; the gill slits little inclined, nearly an eye diameter behind the eye, the upper end below the level of the lower margin of the eye; the scales all have a central granular patch, and most of them on the sides are keeled; the scales between the soft dorsal and anal much larger than elsewhere, those before the first dorsal and about the eyes smallest, the head scaled to the lips; the first dorsal spine rough granular, 1.95 times in the head; when depressed into its groove it is flush with the body; the anterior portion of the second dorsal and anal greatly elevated, falcate, the longest dorsal rays 3.16 times, the anal 3.3 times in the length; the depth of the caudal peduncle 2.5 times in the head; the caudal bilobate, the lower lobe longest, a trifle more than the head; the pectoral 2.16 times in the head, placed just below and behind the gill opening; the ventral spine broad, immovable.

The color in life was uniform brownish violet, the top of the head and the snout brown, the fins all brown. The color in alcohol is little changed, the violet less evident.

Here described from the type, caught with hook and line at Manukan, one of the Cagayan Islands in the Sulu Sea, September 22, 1925. It is about 320 millimeters long.

This species has proved to be common on rocky reefs in the Visayas, large numbers having been caught recently by Japanese fishermen using the Muro Ami method. I have three fine specimens, 350 to 380 millimeters in length, taken at Bennett Island, off the coast of Masbate. Fish of this species were caught by the boatload off the coasts of Tablas and Marinduque. They are rarely eaten and the Japanese fishermen make no attempt to sell them, but throw them away.

BRANCHIOSTEGIDÆ

The body elongate or laterally compressed, the head subconical, its dorsal profile usually convex, often strongly so; there is no bony suborbital stay, the cranial bones are not cavernous, and the opercular bones are usually unarmed; the mouth terminal, oblique, with strong teeth, none on vomer or palatines; the premaxillaries protractile, usually with a blunt posterior canine, much as in the Labridæ; maxillary without supplemental bone, not slipping under edge of preorbital; scales small, ctenoid; a lateral line present, usually following the dorsal outline; dorsal fin long, relatively low, continuous, the spinous part much less developed than the soft portion; anal fin very long, spines few, feeble; ventrals thoracic, I–5, close together; gills 4, with a long slit behind the fourth; pseudobranchiæ well developed; gill membranes separate or more or less united; lower pharyngeals separate; pterygials long, hourglass-shaped, resting on both coracoids; pyloric cæca few or none; vertebræ 24 to 30.

Fishes of temperate and tropical seas, some of them large and excellent food fishes.

Genus **BRANCHIOSTEGUS** Rafinesque

Branchiostegus RAFINESQUE, An. Nat. (1815) 86.
Latilus CUVIER and VALENCIENNES, Hist. Nat. Poiss. 5 (1830) 277.

The elongate, laterally compressed body covered with moderate to small, silvery, finely ctenoid scales; the mouth oblique, rather large, the jaws about equal, with rather strong teeth in the outer row, the inner teeth small, the posterior canine small; the posterior edge of the preopercle finely serrate, the opercle entire; the lips without appendages, and there is no adipose appendage on the nape; six branchiostegals; air bladder simple; pyloric cæca few.

Species few, mostly in the East Indies, north to Japan.

Branchiostegus vittatus sp. nov.

Dorsal VII–15; anal II–11; lateral line 68 to 72; scales in transverse series opposite origin of anal, about 22.

The head and body strongly compressed laterally, the body elongate, tapering, its depth 3.75 to 4 times in the length; the large, deep, boldly convex head 3.48 to 3.63 times in the length, its depth almost equal to that of the body; the snout very steeply inclined, 2.64 to 2.76 times in the head; the large eyes 3.5 to 3.65 times in the head; the interorbital a little less than an eye diameter; the nape produced into a low keel; the mouth large, oblique, very low, the jaws subequal, the posterior angle of the maxillary beneath the pupil of the eye; the upper jaw has an outer row of strong sharp teeth and two inner rows of very small sharp teeth, with four short inner rows at the symphysis; the last tooth of the outer row is a small, hooked, forward-pointed canine; the lower jaw has an outer row of strong teeth as in the upper jaw, and five inner rows of much smaller teeth anteriorly, reduced to one inner row posteriorly; the body everywhere covered with medium-sized scales, apparently cycloid but really very finely ctenoid, the nape scaled forward halfway between the eyes with smaller scales than on the sides, the opercles and cheeks scaled as far as a perpendicular line from the eye to the angle of the mouth, ten rows of scales on the preopercle; the posterior margin of the preopercle finely toothed; the spinous portion of the dorsal low, the seventh spine longest and approximately one-third the depth, the rays higher, the antepenultimate longest, extending on the caudal when depressed, 1.1 to 1.2 times in the depth; the anal shorter and lower, 1.55 to 1.77 times in the depth; the depth of the caudal peduncle 1.12 to 1.32 times in its own length, 2.64 to 2.76 times in the head; the caudal subtruncate or with undulate margin, 4.4 to 4.7 times in the length; the long, narrow, pointed pectorals nearly equal to the depth, 1.1 to 1.2 times in the head, the lower rays abruptly shorter than the middle ones; the origin of the ventrals a little before that of the pectorals, the fins narrow, pointed, about 1.75 times in the head.

The color of fresh specimens was silvery, with a roseate flush along the upper half of the body, the snout bright deep pink; a pearl-colored band crossed the snout in front of the eyes; from the lower front margin of the eye a wide pearl band, rapidly narrowing, descended to the upper lip; from opposite the posterior margin of the pupil a silver band crossed the cheek nearly vertically to the throat; a large, dark brown spot above the origin of the lateral line; a black longitudinal line on the middle of the ridge crowning the nape; the dorsal spines with a black margin; the upper part of the entire dorsal was yellow, with a basal pearly band along its whole length; about six yellow bands on the upper two-thirds of the caudal, running back and a little diagonally upward, the lowest one separated from the rest; each scale above the lateral line with a small dark spot, these spots forming longitudinal rows; below the lateral line a pearly spot on each scale, these spots also forming faint lines; the pupil very large, black.

In alcohol the roseate flush and pink have disappeared and the fin markings are all gone; otherwise the color and markings are the same as when fresh.

Here described from three specimens, 240 millimeters long, collected by me in the Manila market.

Zenarchopterus cagayensis sp. nov.

Dorsal 12–13; anal 13; pectoral 1–9 or 1–8; scales in the lateral line 51–53 from tail to point of division below pectoral; 4 or 5 more to isthmus, 3 or 4 on vertical line to base of pectoral; 77 to over 80 scales from the upper angle of the gill opening to the caudal.

The elongate head and body laterally compressed, the breadth of the body 1.75 to 1.85 times in its depth, which is 7.6 to 7.85 times in the length; the head from the tip of the upper jaw 4.15 to 4.28 times in the length; the entire head to the tip of the lower jaw 1.8 to 1.95 times in the length; the lower beak, beyond the tip of the upper, 3.1 to 3.5 times in the length; the eye large, circular, very high up, its upper margin flush with the interorbital dorsal profile, 1.57 to 1.66 times in the postorbital part of the head and wider than the interorbital space, which is 0.85 to 0.96 of an eye diameter in breadth; the breadth of the triangular part of the upper jaw equals its length, scaly above, the front margin of the preorbital rounded, 2.16 to 2.33 times in the eye; the small conical sharp-pointed teeth in a band of four rows in each jaw, the bands widest anteriorly; the origin of the anal opposite the third or fourth dorsal ray; the dorsal low in females, much higher and centrally pointed in males; in the latter the fifth or sixth ray, or both, much elongated and thickened, the curved tip extending to or upon the caudal, the longest ray equal to the distance from the front margin of the eye to the posterior extremity of the head; the base of the anal 2.25 times in the length of the dorsal base; the anal in females unmodified, not concave; in males the anal rays in three groups, 5 + 4 + 4, the sixth ray greatly widened and thickened, but not greatly elongated, never reaching the caudal; the three succeeding rays similar but successively much narrower, the skin ascendant upon and adherent to them, the last four rays in a deep pit, the whole fin somewhat concave posteriorly; the narrow, pointed pectoral 1.56 to 1.7 times in the head to the tip of the upper jaw; the ventrals very far back, 2 to 2$\frac{2}{7}$ times in the length of the pectoral; the distance from the base of the ventrals to the caudal twice or about twice in the distance from the ventral base to the tip of the upper jaw; the caudal emarginate, the lower lobe somewhat larger and longer than the upper, 5.3 to 5.8 times in the length; the scales deciduous, especially ventrally.

The color in alcohol uniform yellowish brown, with a broad silver band from the angle above the pectoral base to the caudal, widest posteriorly, with a black line along its upper margin; the sides of the head silver, the opercle and side of the lower jaw brilliantly so; the beak blackish; the basal half of the dorsal, behind the fourth ray, black or blackish brown; the caudal more or less yellow or brownish on its base, the rays somewhat dusky; the other fins colorless.

Here described from nine specimens, 100 to 110 millimeters in length, from Pinacanauan River, Tuguegarao, Cagayan Province, Luzon. This is a fragile little fish and but a few of the specimens are in good condition.

PHALLOSTETHIDÆ

This extraordinary and anomalous group of little fishes, belonging to the order Cyprinodontes, seems to be well represented in the Philippines. In an earlier paper [2] I presented a new genus and two new species belonging to this family. I have just received from southeastern Luzon representatives of a new genus which has some characters not hitherto found in the family. In the genera heretofore known the head and nape are scaleless; in the one presented in this paper scales extend upon the head. The males in this family differ remarkably from the females in having a large muscular organ attached to the lower side of the head and throat, bearing one or two elongate, slender, external, more or less movable bones and a penislike structure, at the tip of which the vas deferens ends. This whole organ is a priapium, or copulatory organ. The intestine runs forward and coils within the priapium, opening upon its surface. For further details of family structure see my previous article cited above and also a paper by Regan.[3]

[2] Philip. Journ. Sci. 27 (1925) 507–511.

[3] Proc. Zool. Soc. London 1 (1916) 1–26.

In the genus here described the priapium has some features not found among the previously known members of the order.

As yet this group of fishes is known only from brackish water in Johore and Singapore and from fresh-water lakes and mountain streams of Luzon.

Key to the genera of Phallostethidæ.

a^1. Two dorsal fins, the first of two spines.. **Gulaphallus.**
a^2. One dorsal fin.
    b^2. Nape scaled almost to eyes; opercles scaled; teeth in three or four rows; dorsal 1–6, males with a long external rodlike priapial bone and a very short curved one beside it.................. **Mirophallus.**
    b^2. Head and nape naked; teeth in one or two rows.
        c^1. Dorsal 5 or 6; anal 1–12 to 16; scales 34 to 37; males with a long, smooth, curved external bone (or two?), the ctenactinium, on the priapium.. **Neostethus.**
        c^2. Dorsal 1–7 to 9; anal 1–25 to 27; scales 40; males with an anterior, smooth, rodlike external bone, the toxactinium, and a lateroposterior serrated external bone, the ctenactinium, on the priapium .... **Phallostethus.**

Genus **MIROPHALLUS** novum

This genus differs from the other members of the Phallostethidæ in having scales on the nape and posterior part of the head up to the interorbital space, and in having the opercles covered by a few large scales. In addition, the males have a priapium unlike that of other genera. In *Mirophallus* the priapium is shaped something like a scalene triangle, its long side attached to the underside of the head and throat, from the posterior part of the lower jaw to beneath the base of the pectoral. The lower posterior angle of the priapium is irregular in shape, with a rounded protruding hump which bears on one side a long, slender, cylindrical bone extending forward as far as the mouth and curving over to the opposite side from its origin; this is the equivalent of the toxactinium in Regan's description of *Phallostethus;* in the inner angle and at one side of its expanded base is a short, curved, projecting organ with a supporting bone which projects in a very short sharp claw at the tip; this seems to be the equivalent of the bone on *Phallostethus* named the ctenactinium by Regan; the priapium ends at its posterior angle in a soft hump from which grows a small, very slender, curved and twisted, apparently tubulate organ which is recurved upon the priapium and fits into the hollow between its origin and the base of the toxactinium, its more or less hard and semiosseous tip projecting upward between the base of the toxactinium and the ctenactinium; at its tip is the opening of the vas deferens.

The priapium does not extend down very far, but is folded over near its middle so that it fits closely against the head and throat; the toxactinium then lies along the surface, its tip curving across the base of the lower jaw; the appendages of the priapium may be on either the right or the left side; when the priapium is unfolded, as it must be in copulation, it hangs down as far as the abdominal outline and its appendages are in a position very different from the usual one.

In the female the priapium is represented by a broad thickened ridge; on its anterior half in the median line is the anal opening and a little back of the middle is the larger genital opening; at the posterior end is a short thick fleshy papilla. Vertebræ 33.

Mirus, wonderful; *phallus*, the copulatory organ.

Mirophallus bikolanus sp. nov.

Dorsal 1–6; anal 1–14; there are 32 scales in a longitudinal series, 6 in a vertical series from the origin of the dorsal, and 25 before the first dorsal.

The head and body strongly compressed laterally, slender, elongate, the dorsal profile nearly horizontal, the ventral profile more or less convex. In females the depth is 4.6 to 5 times, the head 4.3 to 4.5 times in the length; the head pointed, with short, blunt snout, nearly vertical mouth, and strongly projecting chin, the tip of which rises to the dorsal profile; the large circular eye very high up, lateral, 2.5 to 2.8 times in the head, from a little more to half more than the snout; the broad flat or nearly flat interorbital a tenth to a fourth more than the eye; the very minute teeth in bands; there are three rows in the upper jaw, and four in the lower jaw; the lower band divided into two parts by a toothless space at the middle, the whole band crescent-shaped; the posterior margin of the maxillary in advance of or extending to a point beneath the front margin of the eye; the dorsal highest anteriorly, 1⅔ times to twice in the head, very far back; the anal much longer than the dorsal, its origin much in advance of the dorsal but in the posterior half of the body, the spine low but the anterior rays high, becoming progressively shorter posteriorly, 1.5 to 1.7 times in the head; the pointed pectoral 1.2 to 1.3 times in the head; the caudal elongate, narrow, truncate, equal to or longer than the head, rarely a little shorter, 3 to 4.6 times in the head.

Males a trifle slenderer, the depth 4.9 to 5.2 in the head, 5.5 to 5.7 times in the length; the eye 2.2 to 2.3 times in the head, and about a tenth less than the interorbital; the snout 1.2 to 1.8 times in the eye; in other measurements of the body and fins they do not differ from the females.

The color in alcohol whitish with a thin black line on the side, beginning high up a little before and above the posterior end of the pectoral and running back to the middle of the caudal; the dorsal scales outlined by circular black dots; the top of the head black, the snout, sides of the head, and chin thickly sprinkled with black dots; beginning forward of the anal fin a black line or row of black dots extends back at the base of the anal until it meets its fellow from the opposite side at the posterior end of the fin, and the two continue as one along the median line to the caudal; the dorsal and caudal are dusky, the other fins clear. In males the ventral surface of the folded priapium more or less blackened.

I have examined twenty-eight female specimens, 15 to 24 millimeters in length, and twenty-two males, 16 to 24 millimeters in length, from Lake Bato, Camarines Sur Province. From Lake Lanigay, Albay Province, I have four females, 19 to 27 millimeters long, and three males, 22 to 23 millimeters in length.

This tiny fish is entirely unlike any other member of the family yet described.

Bikolanus, pertaining to the Bikol provinces.

ILLUSTRATIONS

PLATE 1

Canthidermis viola sp. nov., × ⅓. (Drawing by Antonio Canlas.)

PLATE 2

Branchiostegus vittatus sp. nov., × ⅔. (Drawing by J. L. Nievera.)

PLATE 3. MIROPHALLUS BICOLANOS SP. NOV., × 3⅓. (Drawings by Pablo Bravo.)

FIG. 1. Adult male, lateral view, showing the toxactinium in a folded position; *p*, penal structure; *c*, ctenactinium; *t*, toxactinium.

FIGS. 2 to 4. Adult male, partial views, showing the toxactinium in an unfolded position; *2*, ventral view of head; *3*, left side view of head; *4*, right side view of head.

FIG. 5. Adult female, lateral view; *o*, oviduct; *a*, anus.

6. Adult female, ventral view of head.

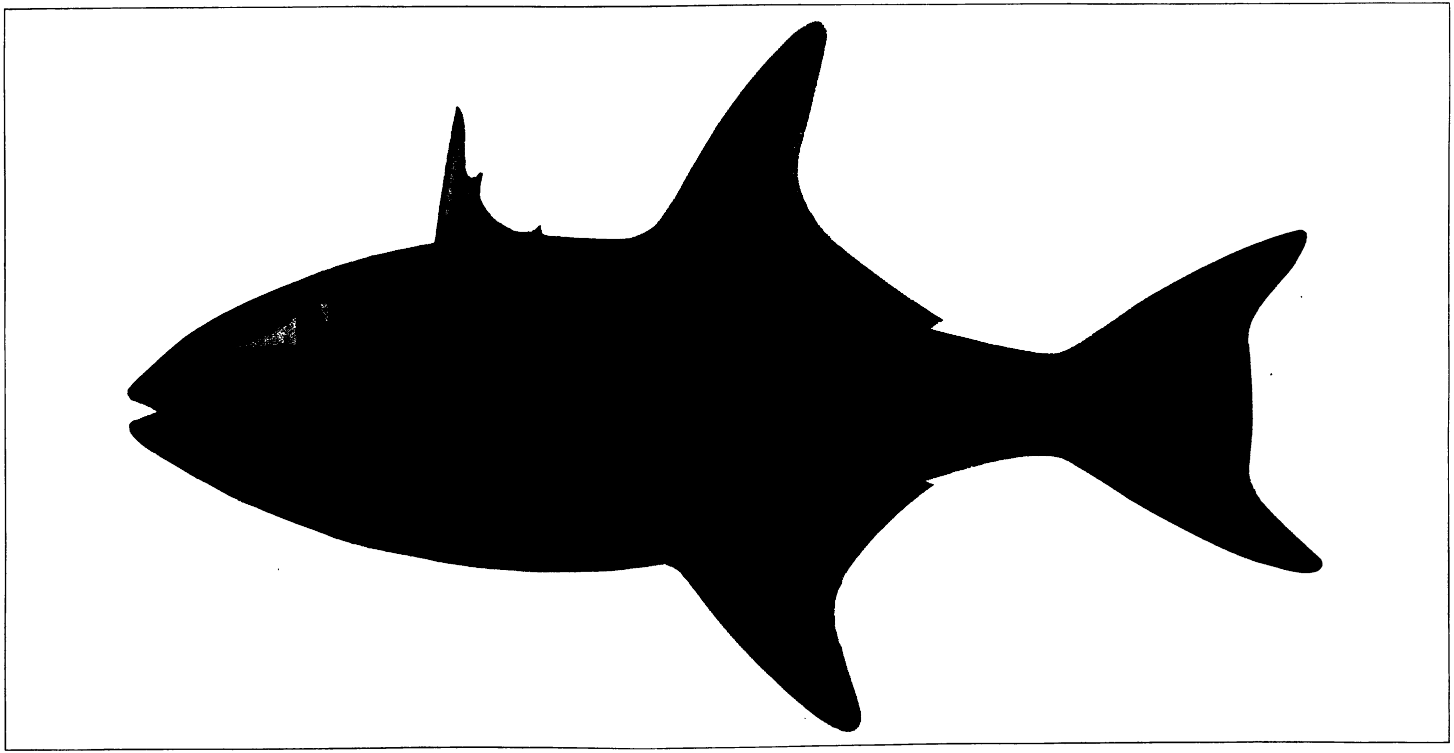

PLATE 1. CANTHIDERMIS VIOLA SP. NOV.

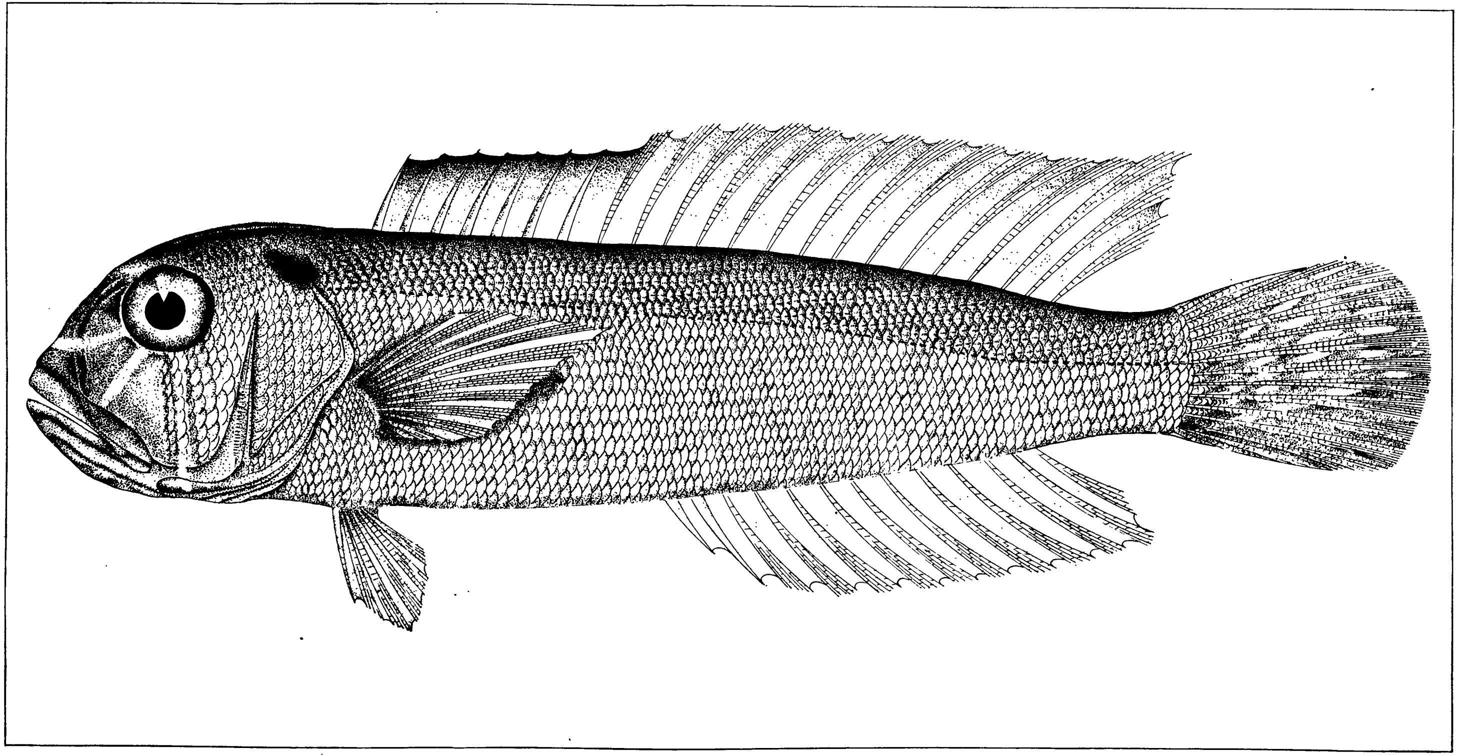

PLATE 2. BRACHIOSTEGUS VITTATUS SP. NOV.

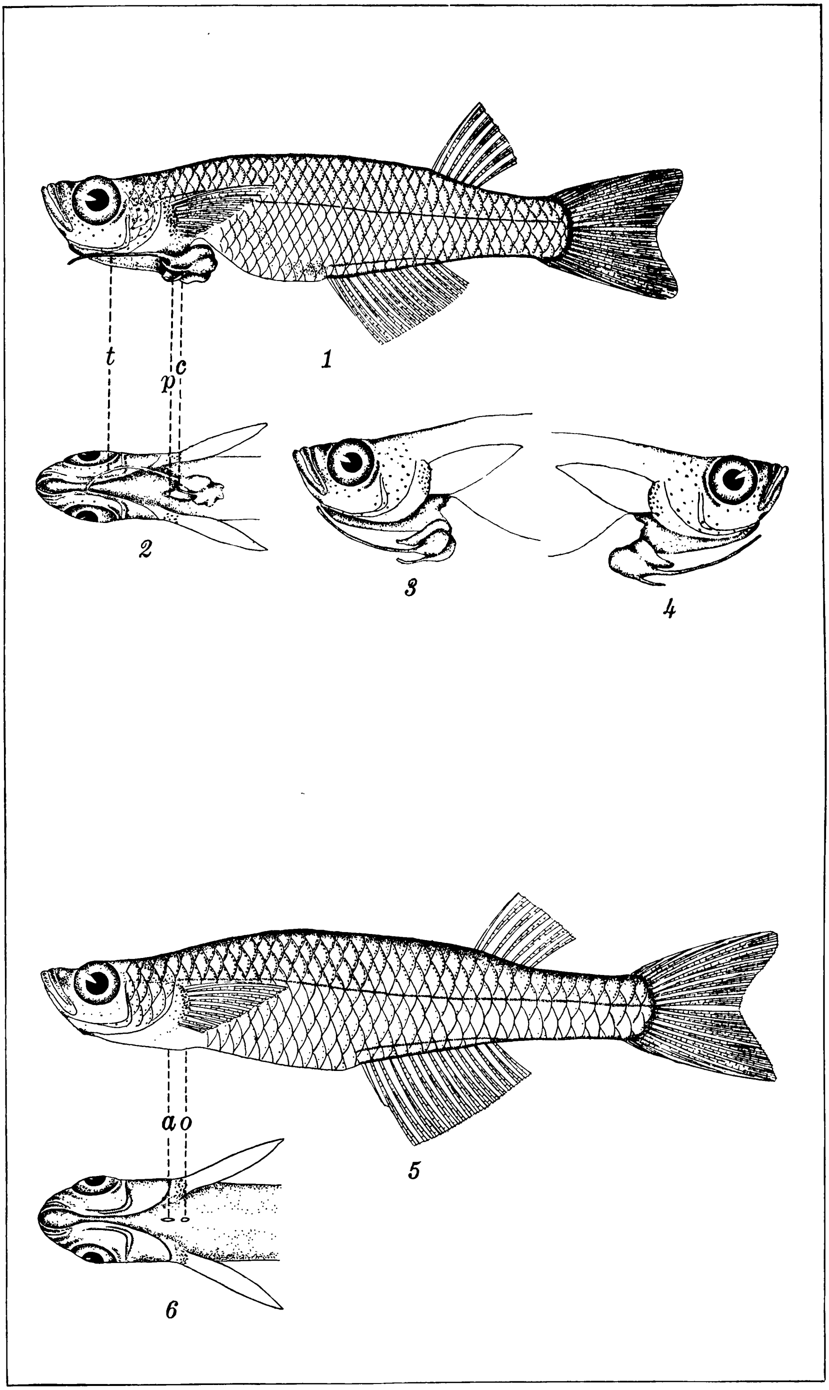

PLATE 3. MIROPHALLUS BIKOLANUS SP. NOV.

ERRATA

Volume 30, page 413, line 18, for *hirtella* (Ridl.) comb. nov. read *hirtella* (Ridl.) Merr.

VOLUME 31

Page 105, line 11, *for* **Leptotrichalus effeminautus** Kleine. *read* **Leptotrichalus effeminatus** Kleine.

Page 260, line 34, *for* **P. brevicristatus** var. **deletus** Fauvel. *read* **T. brevicristatus** var. **deletus** Fauvel.

Page 260, line 45, *for* **P. longipennis** sp. nov. *read* **T. longipennis** sp. nov.

Page 261, line 2, *for* **P. philippinus** sp. nov. *read* **T. philippinus** sp. nov.

Page 261, line 13, *for* **P. minutissimus** sp. nov. *read* **T. minutissimus** sp. nov.

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[New generic and specific names and new combinations are printed in clarendon; synonyms and names of species incidentally mentioned in the text are printed in *italic*.]

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